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ABSTRACT

As part of the high school vocational industrial program in Manitoba, this course has been designed to provide students with the foundation for a career in auto-body repair. The program introduces and provides opportunities for student skill development in the theories and techniques of tool and equipment operation, metallurgy and welding, damage analysis, frame and alignment replacement and repair, refinishing and painting, and shop organization and management. The course emphasizes attainment of industry-level standards in an effort to promote career success and personal satisfaction. The program, consisting of 12 blocks with the first 10 being essential, is expected to make up 50 percent of the student's education in this area. Each block is organized to meet its specific objectives and includes teacher's notes, suggested activities for each goal or objective, and suggested supplemental materials. A bibliography of printed materials and audiovisual aids follows the blocks. (KC)

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auto body repair 103, 203, 303

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This guide replaces the interim curriculum guide for Vocational Industrial Auto Body Repair 104, 204, 304 issued in 1971. It has been developed as part of an overall revision of the Vocational Industrial programs for the secondary schools of Manitoba, and is based on recommendations included in the Vocational Area Task Force Report of 1978 as well as suggestions from secondary school and community college teachers and representatives from industry.

Auto Body Repair 103, 203, 303 (1982) becomes the approved provincial guide for auto body repair in the secondary school effective September 1982.

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The Department would like to thank the staff and students of Kildonan-East Regional Secondary School, River East School Division No. 9, for their cooperation in the taking of the photograph which illustrates the cover of this guide.

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RATIONALE

As part of the Vocational Industrial program, Auto Body Repair 103, 203, 303 has been designed to provide students with the foundation for a successful and safety-conscious vocation in the career field of auto body repair. The program introduces and provides opportunities for student skill development in the theories and techniques of tool and equipment operation, metallurgy and welding, damage analysis, frame and alignment replacement and repair, refinishing and painting, and shop organization and management. The emphasis is on the attainment of industry-level standards in support of career success and personal satisfaction.

Students having an avocational interest in achieving personal development and self-expression through auto body repair may be served through the provision of one or more non-sequential blocks from the program pattern as optional credit offerings to meet the requirements of high school graduation.

PROGRAM PATTERN

For students wishing to specialize in Auto Body Repair, a program consisting of 12 credits (blocks) has been developed, comprising 50% of the education of the student. A maximum of four credits is available for each of Auto Body Repair 103, 203, 303, and it is recommended that two credits or blocks be taken in each semester from grade 10 to grade 12.

NOTE: Blocks 1-10 are core blocks; Blocks 11 and 12 are optional blocks for specific preparation for employment or post-secondary education.

TIME ALLOTMENT

Each of Auto Body Repair 103, 203, and 303 consists of four blocks of one credit each, with a credit being defined as a minimum of 110 hours of instruction.

SPECIAL NEEDS

Both gifted students and those with special handicaps may benefit from the study of auto body repair. The decision to provide program streams or individual credits rests with the school. To the extent that such offerings require the mastery of course objectives, these studies can provide learning experiences valuable to special needs students' success in a wide range of vocational opportunities related to auto body repair.

EVALUATION

Auto Body Repair credits (blocks) emphasize both the practical aspects of skill mastery and the principles associated with theories in auto body repair. Evaluation should address both of these learning domains and should be be based on the objectives of the curriculum. Periodic tests would serve to measure achievement so that the required sequence of skill development would be monitored.

Because of the wide variety of offerings and emphases in the program, student achievement may be assessed on an individual basis, focusing on the areas which best correspond to particular interests and aptitudes. In each case, however, the standards common to the business sector provide a valid and reliable measure of the extent to which objectives should be met. Generally, it is considered appropriate in vocational industrial courses to assign 60% of the final mark for practical work and 40% for theoretical knowledge.

INTEGRATION OF INFORMATION AND SKILLS

It is recommended that teachers of Auto Body Repair 103, 203, 303 emphasize vocabulary study, safety, career information, shop organization, and estimating procedures throughout the program pattern. To this end, the topics are woven into each block.

ROLE OF TEXTBOOKS

Auto Body Repair 103, 203, 303 allows for flexibility in scope and approach by encouraging teachers to plan the blocks in the program pattern by using the guide as a framework and enriching or modifying to meet the needs of students. Since no one textbook serves all blocks for all students, it is important that teachers have access to, and become acquainted with, a wide variety of resources including methodological approaches, sources of projects, exercises, and enrichment activities.

GOALS AND OBJECTIVES

In general, the goals for vocational industrial education in the secondary school will be similar for all industrial education program patterns. Differences among program patterns will occur in the emphasis placed upon the following:

- general goals and/or more specific objectives;
- recognition of vocational and avocational goals;
- requisites for high school graduation, employment, and post-secondary education;
- scope and sequence of the program pattern;
- selection of the blocks and the content of the blocks comprising the program pattern;
- maturity, abilities, and expectations of the students;
- laboratory and equipment for the program pattern.

Goals of Auto Body Repair 103, 203, 303

1. To familiarize students with the auto body trade, including career and employment opportunities, trade ethics, safety and shop organization and management, and tool and equipment use and operation.

2. To introduce students to, and to provide opportunities for students to practice, the skills necessary for analyzing and undertaking necessary repairs, including welding, filling and patching, painting and refinishing, and replacement and repair of damaged auto body components.

3. To promote the attainment by students of industry-level standards in auto body repair.

Objectives for Auto Body Repair 103, 203, 303

I. Introduction to Auto Body Repair

The student should be able to:

- collect information about the Auto Body Repair Program;
- recognize the relationship between career and employment opportunities and the Auto Body Repair Program;
- trace the historical development of the auto body repair trade;
- list the trades that merged to form the auto body repair trade;
- identify careers currently associated with the auto body repair trade;
- locate information about the various occupations available in the auto body repair trade and the entry requirements;
- develop an understanding of employment law relevant to the auto body repair trade;
- discuss employment opportunities in the auto body repair trade;
- explain journeyman certification requirements;
- understand the need for and the importance of ethics in the auto body repair trade;
- demonstrate ethical conduct in the school and the auto body repair shop;
- list the requirements of a pleasing personality;
- recognize the importance of a neat personal appearance;
- explain responsibilities to the auto body repair trade and to oneself;
- demonstrate a knowledge of the routine of the auto body repair shop;
- describe procedures to be followed in the auto body repair shop;
- list possible unsafe conditions which might lead to injuries;
- explain the purpose and the use of accident report forms;
- accept responsibility for developing safety habits;
- identify the types of hand tools used in the auto body repair shop;
- use the hand tools correctly;
- identify the types of power tools and major repair equipment used in the auto body repair shop;
- use the power tools and the major repair equipment in the auto body repair shop.

II. Metals and Oxyacetylene Welding

The student should be able to:

- define metallurgy;
- explain the relationship of metallurgy to auto body repair;
- identify the metals commonly used in auto body manufacturing;
- describe the characteristics of metals commonly used in auto bodies;

- identify and discuss the components of an auto body;
- explain the purpose of the auto body components;
- identify the major causes of damage to the auto body components;
- define welding;
- recognize the importance of oxyacetylene welding in auto body repair;
- identify and describe the gases and the equipment used in the oxyacetylene welding process;
- list and explain the steps in setting up equipment;
- set up the equipment;
- turn off the equipment;
- identify and describe the processes for welding sheet and plate metal;
- use oxyacetylene welding equipment to prepare every type of weld in three positions;
- identify the uses of oxyacetylene cutting;
- demonstrate the ability to use the oxyacetylene process for cutting;
- describe the effect of heat on sheet metal;
- use oxyacetylene equipment to demonstrate the effect of heat on sheet metal.

III. Replacing and Repairing Damaged Panels

The student should be able to:

- recognize the auto body components;
- list the major causes of damage to auto body components;
- identify the types of collision damage;
- describe the types of collision damage;
- identify the trunk lid;
- explain the construction of the trunk lid;
- describe the procedures for replacing and repairing a trunk lid;
- repair a trunk lid;
- identify the rear-end panel;
- explain the construction of the rear-end panel;
- describe the procedures for repairing a rear-end panel;
- repair a rear-end panel;
- identify the components of the front-end section;
- explain the construction of the front-end section;
- describe the procedures for repairing damage incurred during a front-end collision;
- identify the materials used for filling;
- explain the purpose of the plastic filling process;
- prepare the surface for plastic filler;
- mix and apply plastic body filler;
- identify the materials used for patching;
- explain the purpose of patching with flat sheet metal;
- apply a sheet metal patch.

IV. Introduction to Paint Preparation

The student should be able to:

- identify the paint supplies, tools, and equipment;
- list reasons for refinishing;
- explain the process of preparing the outer surface of the vehicle;
- choose and use appropriate cleaning procedures;
- identify and describe abrasives for surface preparation;
- explain and use sanding operations;
- select and prepare paint;
- explain the purpose of masking;
- identify masking materials;
- apply masking materials;
- remove masking materials;
- identify a suction-feed spray gun;
- explain the operating principle of the suction-feed spray gun;
- identify the parts of the suction-feed spray gun and explain their functions;
- demonstrate the procedures for dismantling and assembling a suction-feed spray gun;
- clean a suction-feed spray gun;
- maintain a suction-feed spray gun.

V. Review and Introduction to Hydraulic Power Equipment

The student should be able to:

- demonstrate the ability to apply the concepts and the skills of Block I: Introduction to Auto Body Repair;
- apply the concepts and the skills of Block II: Metals and Oxyacetylene Welding;
- apply the theories and demonstrate correctly the procedures of Block III: Replacing and Repairing Damaged Panels;
- use the skills and apply the concepts of Block IV: Introduction to Paint Preparation;

- identify the types of hydraulic equipment used in the auto body repair shop;
- explain the uses of hydraulic equipment;
- use hydraulic equipment;
- explain and use care and maintenance procedures.

VI. Body Alignment; Replacement/Repair of Panels and Electrical Assemblies

The student should be able to:

- recognize the importance of analyzing damaged metal prior to deciding on replacement and repair procedures;
- classify conditions of metal damage;
- determine the direction of the damaging force;
- analyze the direction of the damage and the damage conditions;
- explain the construction of the automobile door;
- identify the components mounted on the inner door frame;
- describe the procedures for replacing and repairing the outer panel of a door;
- replace/repair an outer door panel;
- develop an understanding of the different types of window construction;
- identify the components of door window assemblies;
- describe the procedures for replacing door windows;
- replace door windows;
- identify and describe the types of construction and installation for windshields and rear windows;
- explain the procedures for replacing windshields and rear windows;
- remove and replace windshields and rear windows;
- identify and define interior trim panels;
- describe the fabrication of interior trip panels;
- list the procedures for removing and installing interior trim panels;
- remove and install interior trim panels;
- identify and define headlining;
- describe the fabrication of headlining;
- list the procedures for removing and installing headlining;
- remove and install headlining;
- understand/use techniques for replacing/repairing other types of upholstery and interior trim;
- define fibreglass;
- explain the composition and the characteristics of fibreglass;
- compare the effect of damage on metal and fibreglass parts;
- identify tools and materials for replacing/repairing fibreglass;
- explain the fibreglass replacement/repair procedures;
- repair minor fibreglass damage;
- repair/replace major fibreglass damage;
- identify and locate the common electrically operated devices;
- collect information about other electrical devices controlled by the body electrical system;
- explain basic electrical concepts;
- repair electrical circuits and replace electrical components;
- test, remove, install, and charge a battery;
- replace damaged light assemblies;
- align headlights.

VII. Electric Welding

The student should be able to:

- recognize the importance of electric welding in the auto body repair trade;
- identify the basic methods of electric welding;
- define electric arc welding;
- identify the types of electric arc welding;
- identify, describe, and set up equipment for the various types of electric arc welding;
- describe the procedures for shielded-metal arc welding;
- use electric arc welders for shielded-metal arc welding;
- describe the procedures for gas-shielded arc welding;
- make live repairs using MIG and TIG welding;
- define spot welding;
- identify the types of spot welding;
- identify, describe, and set up equipment for the various types of spot welding;
- perform spot welding procedures.

VIII. Refinishing and Painting

The student should be able to:

- list the basic types of auto body repair paint jobs;
- identify the auto body skills related to refinishing and painting;
- use the refinishing skills covered in Auto Body Repair 103;
- identify and describe the surface preparation steps;
- clean and prepare the surface to be repainted;
- identify and use pre-painting procedures;
- identify the types of paint;
- list the basic characteristics of each type of paint;
- identify and explain the paint ingredients;
- select, match, and mix paint;
- collect information about the structure and the purpose of spray booths;
- identify spray painting equipment;
- explain the purpose of spray painting equipment;
- operate and maintain spray guns;
- apply paint to spot-repair small areas of a car;
- paint fenders, doors, deck lids, and hoods;
- paint an entire automobile;
- explain the drying process.

IX. Theory Review, Plastic Repair, Frame and Alignment Fundamentals

The student should be able to:

- apply the concepts and use the skills of Block V: Hydraulic Power Equipment;
- apply the theories and demonstrate the correct usage of procedures in Block VI: Body Alignment, Replacement/Repair of Panels and Electrical Assemblies;
- apply the concepts and use the skills in Block VII: Electric Welding;
- use the skills and apply the concepts of Block VIII: Refinishing and Painting;
- collect information about the use of plastics in the construction of automobiles;
- list the three basic types of plastics used for car parts;
- identify the main characteristics of the basic types of plastics;
- determine the type of plastic in various automobile parts;
- explain the plastic repair procedures;
- repair soft plastic parts;
- define hot-air plastic welding;
- identify, describe, and set up the equipment for hot-air plastic welding;
- explain the requirements for good plastic welding;
- describe the repair sequence for hot-air welding;
- repair plastic with hot-air welding;
- explain and use procedures for painting plastic parts;
- identify the frame of an automobile;
- recognize the two types of frame design;
- describe the types of utilized frames;
- explain the relationship of frame construction and damage to alignment;
- interpret the concept of controlling points in body-frame straightening;
- collect information about the three sections of the frame;
- list the basic types of frame misalignments;
- diagnose body-frame damage;
- prepare the car for straightening;
- straighten the body and the frame and restore the alignment;
- explain the theory of wheel alignment;
- describe the types of equipment for wheel alignment;
- align the wheels of a car.

X. Major Body Damage and Collision Repair

The student should be able to:

- identify the front-end components;
- diagnose front-end damage;
- repair the frame and underbody damage;
- repair damaged front-end sheet metal panels;
- install and align repaired and/or new sheet metal panels;
- diagnose rear-end damage;
- repair rear-end damage;
- diagnose side collision damage;

- repair the side collision damage;
- explain the construction of a turret top;
- diagnose turret top damage;
- describe the procedures for repairing a turret top;
- repair a turret top;
- describe the procedures for replacing a turret top;
- replace a turret top.

XI. Shop Organization and Management

The student should be able to:

- identify the seven basic operational areas for an auto body repair shop;
- explain the purpose of each of the areas;
- list the management activities;
- explain the purpose of supply and material management;
- use and maintain a material control system;
- explain the purpose of and the procedures for the office management functions;
- identify the need for and the importance of customer relations;
- list ways of building and maintaining good customer relations;
- explain the purposes of estimating;
- identify and describe the types of estimates;
- compare the types of estimates;
- identify and use the information sources for estimates;
- collect information about estimating forms;
- explain the estimating procedures;
- prepare estimates.

XII. Advanced Refinishing and Painting

The student should be able to:

- use the surface preparation skills from Block VIII: Refinishing and Painting;
- demonstrate the use of knowledge and skills about painting from Block VIII: Refinishing and Painting;
- appraise the readiness of the body surface for painting;
- choose paint appropriate to the type of body material;
- prepare lacquer paint for spraying;
- apply lacquer paint;
- use post-painting procedures to finish the lacquer surface;
- prepare enamel and synthetic paints for spraying;
- apply enamel and synthetic paints;
- identify paint problems;
- define the various paint problems;
- explain the causes of paint problems;
- describe the prevention techniques;
- choose procedures to correct paint problems;
- use procedures to correct paint problems;
- recognize the relationship of custom painting to the auto body repair trade;
- identify and describe the equipment and materials for painting special effects;
- describe the custom finish procedures;
- explain masking procedures for custom painting;
- create and use a design or several designs for painting special effects.

block i: introduction to auto body repair

General Objectives: To familiarize the students with the Auto Body Repair program; historical development; career and employment opportunities; trade ethics; safety and shop organization; hand and power tools and equipment.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
I. INTRODUCTION TO AUTO BODY REPAIR	Integrate and emphasize this section throughout Auto Body Repair 103, 203, 303.	
	Outline and discuss the content of the Auto Body Repair Program. Prepare posters, transparencies, and/or slides for use during the discussion.	Auto Body Repair Program Handbook Posters/transparencies/slides
A. Program Orientation The student should be able to:		
1. collect information about the Auto Body Repair Program;	Have the students gather information and prepare a paper describing the Auto Body Repair Program.	Administrative Handbook for Manitoba Schools School/Student Handbook Curriculum Guide for the Auto Body Repair Program
2. recognize the relationship between career and employment opportunities and the Auto Body Repair Program;	Describe the relationship between the high school Auto Body Repair Program and post-secondary programs. Have the students prepare several types of career ladders pertinent to auto body repair. Encourage the students to research information and to prepare bulletin board displays and/or reports about employment opportunities.	Newspaper advertisements The Canadian Classification and Dictionary of Occupations, Department of Manpower and Immigration Canada An Analysis Auto Body Mechanic Trade, Department of Manpower and Immigration Canada
B. Historical Development and Career Opportunities	Have the students prepare and maintain a notebook as an ongoing project. Discuss the purposes of maintaining a well-organized notebook. Encourage the students to include the following in the notebook project: sketches, illustrations, diagrams, articles from technical periodicals, instruction sheets related to new parts.	PURPOSE OF NOTEBOOK PROJECT 1. To provide a record of learning and progress 2. To develop a storehouse of reference information
The student should be able to:		
1. trace the historical development of the auto body repair trade;	Discuss the historical development of auto body construction from the era of the horseless carriage to the present.	Collector's History of the Automobile, Bonanza Books

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		The Complete Encyclopedia of Motorcars 1885-1968, E. P. Dutton and Company, Inc.
	Have the students prepare a chart/booklet/report/bulletin board display of historical events and a time line of the developments.	The Story of Cars, G. P. Putnam's Wheels and Pistons, Four Winds Press Wheels on the Road, Collier-Macmillan, Ltd.
2. list the trades that merged to form the auto body repair trade;	Discuss and have the students prepare reports explaining the contributions of the various trades to the development of the auto body repair trade. List and discuss the trades that merged to form the auto body repair trade. Explain how the trades merged to form the auto body repair trade.	TRADES MERGING TO FORM AUTO BODY REPAIR TRADE 1. Carriage making 2. Tinsmithing 3. Upholstering 4. Appliance painting 5. Welding
	Integrate information and learning activities about career and employment opportunities and post-secondary education throughout the complete auto body repair program.	Career sections of daily newspapers.
3. Identify the careers currently associated with the auto body repair trade;	Discuss career opportunities with the students. Have the students research and prepare a list of auto body repair occupations and identify the firms, companies, and institutions associated with the occupations.	Newspaper advertisements Yellow pages of the telephone directories An Analysis Auto Body Mechanics Trade, Department of Manpower and Immigration Canada Training Manual for Canadian Classification and Dictionary of Occupations, Volume I, Department of Manpower and Immigration Canada The Canadian Classification and Dictionary of Occupations, Department of Manpower and Immigration Canada

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
4. locate information about the various occupations available in the auto body repair trade and the entry requirements;	Encourage the students to read about and discuss the various occupations. Have them prepare a poster or bulletin board display indicating the occupations and the related entry requirements.	Posters and bulletin board displays
	Invite guest speakers to present information to the students about automotive careers.	
	Have the students design and use an interview form to obtain information about auto body repair careers.	Interview forms
5. discuss employment opportunities in the auto body repair trade;	Explain and identify employment opportunities on a local, regional, and national basis. Point out that in small shops some of the jobs may be combined.	AUTO BODY SHOP WORKERS 1. Manager 2. Foreman/woman 3. Estimator 4. Body-repair technician 5. Power-equipment operator 6. Painting and refinishing technician 7. Upholsterer 8. Glass technician 9. Clerical staff 10. Other Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter I An Analysis--Auto Body Mechanic Trade, Department of Manpower and Immigration Canada The Canadian Classification and Dictionary of Occupations, Department of Manpower and Immigration Canada
6. explain journeyman certification requirements;	Discuss the legislation and education related to journeyman certification.	The Apprenticeship and Tradesmen's Qualifications Act, Manitoba Statutes, Queen's Printer

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
7. develop an understanding of employment law relevant to the auto body repair trade;	Discuss the following: getting the job, the relationship of master and servant, the employment contract, on-the-job duties and responsibilities.	Employment Law (PLEA), available from Department of Education Library, 1181 Portage Avenue, Winnipeg, Manitoba R3G 0T3 Practical Legal Skills: Employment Rights and Responsibilities (PLEA), available from Department of Education Library, 1181 Portage Avenue, Winnipeg, Manitoba R3G 0T3
C. Ethics and Attitudes The student should be able to:		
1. understand the need for and the importance of ethics in the auto body repair trade;	Discuss ethical conduct related to working with and handling the personal property of a customer. Explain the need for the respect and care of the property of other persons. Discuss the legal implications outlined in the law of bailments.	Property and Succession Law (PLEA), available from Department of Education Library, 1181 Portage Avenue, Winnipeg, Manitoba R3G 0T3 Case studies
	Have the students discuss the concept of the "duty of care" as it pertains to the automobiles repaired in the school shop and by auto body repair businesses.	All About Law, John Wiley and Sons, pp. 222-233 Canadian Law, 3rd ed., McGraw-Hill Ryerson, Ltd., pp. 270-286
2. demonstrate ethical conduct in the school and the auto body repair shop;	Emphasize the importance of, and encourage the students to demonstrate ethical conduct through manners, cheerfulness and punctuality in the school and in the auto body repair shop.	
3. list the requirements of a pleasing personality;	Discuss the importance of a pleasing personality in relation to the auto body repair trade. Explain and illustrate how speech, behaviour and manners indicate one's personality.	Case studies

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
4. recognize the importance of a neat personal appearance;	Discuss the basics of good grooming and clothing. Have the students prepare and act out a skit to emphasize the importance of grooming and clothing in relation to the auto body shop. Explain the need for tight fitting clothing to prevent accidents.	BASICS OF GOOD GROOMING 1. Care of clothing 2. Care of feet 3. Care of skin and hair 4. Care of nails and hands Charts, bulletin board displays of clothing and footwear for the auto body repair shop
5. explain responsibilities to the auto body repair trade and to oneself.	Observe student appearance and behaviour. Explain the importance of reporting on time for work and for adhering to a schedule and a time for job completion.	
D. Safety and Shop Organization The student should be able to:	Outline the duties related to office and shop routines and/or have the students research and report on or role play these techniques and routines.	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapters 3 and 9
1. demonstrate a knowledge of the routine of the auto body repair shop;	Take the students on a tour of the auto body shop and emphasize the importance of safety, cleanliness, and organization in the auto body repair shop. Encourage the students to study the safety charts, posters, and signs placed around the shop. Have the students locate the fire extinguishers, first-aid kits, telephones, and fire exits.	Auto body repair shop Student work stations
2. describe procedures to be followed in the auto body repair shop;	Discuss and have the students analyze these procedures in order to increase efficiency and safety. Explain the importance of and have the students participate in the daily shop cleanup. Prepare or have the students prepare a set of slides with a cassette commentary describing shop procedures.	Bulletin board display of well-kept auto body repair shop student work stations

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
3. list possible unsafe conditions which might lead to injuries;	Make the students aware of the importance of orderliness and safety in the auto body repair shop. Have the students list and assess the consequences of unsafe acts relating to persons, materials, tools, and equipment.	Pictures, photographs, charts of unsafe conditions POTENTIAL DANGERS 1. Eye injury 2. Lifting 3. Hot metal 4. Sharp metal 5. Compressed air 6. Hand tools 7. Hoists 8. Jacking devices 9. Jackstands 10. Power equipment 11. Welding equipment
4. explain the purpose and the use of accident report forms;	Discuss accident report forms and have the student complete an accident report form. Explain the function of and the benefits available under The Workers Compensation Act.	Examples of accident report forms The Workers Compensation Act, Manitoba Statutes, Queen's Printer Introduction to Auto Body Safety, Number 1A1
5. accept responsibility for developing safety habits.	Make the students aware that they are responsible for safety. Emphasize that safety in the shop means protecting oneself and others from possible injury and danger. Explain and demonstrate the ABC of safety: Always Be Careful! Remind students frequently about the need to be safety conscious by integrating safety instruction throughout the program.	Safety/Health Guide for Industrial Arts, Vocational Industrial, Home Economics, and Business Education, Manitoba Department of Education Auto Body Safety, Number AB-0-2A (cassettes, filmstrips, worksheets), AIM Educational Aids The Workplace Safety and Health Act, Manitoba Statutes, Queen's Printer

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
E. Hand and Power Tools and Equipment	Integrate use, care, and maintenance of hand tools, power tools, and equipment throughout the instruction of the auto body repair program.	Copies of automobile manufacturers' body-service manuals
The student should be able to:		
1. identify the types of hand tools used in the auto body repair shop;	Acquaint the students with the various types of hand tools. Emphasize that a modern auto body repair shop requires an increasing number of hand tools. Have the students prepare charts/lists identifying the hand tools and their major uses.	Display/s, chart/s, transparencies of hand tools Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 5 Autobody Repairing and Repainting, The Goodheart-Willcox Company, Inc., Chapters 2,3 Tool Identification, Number AB-P-I (cassettes, filmstrips, worksheets), AIM Educational Aids Hand Tools and Power Equipment; Autobody Repair: Metal Work series (filmstrip, cassette, instructor's guide), Prentice-Hall, Inc.
2. use the hand tools correctly;	Explain that the basic hand tools come in many sizes and shapes and that each type serves a special purpose. Emphasize the importance of keeping up to date on tool design changes and on the new tools under development. Explain the relationship between the ever-changing automobile body designs and the requisite hand tools.	BASIC HAND TOOLS 1. Hammers 2. Dolly blocks 3. Body spoons 4. Pick tools 5. Pry bars 6. Files 7. Brushes 8. Chisels 9. Hacksaws 10. Pliers 11. Punches 12. Scrapers

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		13. Screwdrivers 14. Sheet metal cutters 15. Vises 16. Wrenches
	Demonstrate the correct use of hand tools. Have the students identify and use the various types of hand tools required for particular auto body repair jobs. Encourage the students to acquire the skill of using hand tools to complete auto body repair jobs in a correct and safe manner. Have the students give reasons for safety precautions related to hand tools. Discuss the maintenance and care of hand tools.	HAND TOOL SAFETY 1. Wear safety glasses when using a hammer against metal. 2. Use a file with a properly fitted handle. 3. Exercise care when using piercing punch. 4. Use a metal probe to remove particles of body filler lodged in the grater file cutting surfaces. 5. Position the bumper bracket tool to prevent slippage during application of pressure. 6. Choose and use suction cups in good condition for holding and positioning glass.
	Refer the students to conversion charts for metric equivalents.	Charts for metric equivalents
	Discuss the relevance of the metric system to the hand tools for the auto body repair trade.	Auto Hand Tool Safety, Numbers IA2 and IA3 (sound filmstrip), AIM Educational Aids
3. Identify the types of power tools and major repair equipment used in the auto body repair shop;	Acquaint the students with and discuss the importance of the various types of power tools and major repair equipment pertinent to the efficient operation of the auto body repair shop. Explain the relationship between the ever-changing automobile body designs and the requisite power tools and major repair equipment.	Display of power tools and major repair equipment/ chart/s, picture/s of power tools and major repair equipment POWER TOOL: A tool of which the power source is electricity/air

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
4. use the power tools and the major repair equipment in the auto body repair shop;	Discuss the purpose and demonstrate the correct use of the various types of power tools and major repair equipment. Give the student considerable practice in identifying and using the power tools and major repair equipment before allowing them to use the tools and the equipment on an actual repair job. Make the students aware of the difficulty or impossibility of correcting damage caused by high operating speed and improper use of power tools and equipment.	SOME BASIC POWER TOOLS 1. Grinders 2. Sanders 3. Polishers 4. Portable power drills 5. Pneumatic impact tools 6. Riveters 7. Pneumatic wrenches 8. Drills 9. Vacuum cleaners 10. Pain shakers Tool manufacturers' operating instructions Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapters 6,7
	Stress the importance of learning and practicing safety rules thoroughly and constantly in order to minimize injury to self and to coworkers. Have the students prepare/study safety precaution charts related to power tools and major repair equipment. Emphasize, discuss, and demonstrate the care and maintenance of power tools and major repair equipment.	Power Tools, Number 9205 (filmstrip/slide sets/video tapes), AIM Educational Aids Hand Tools and Power Equipment, Autobody Repair: Metal Work series (filmstrip, cassette, instructor's guide), Prentice-Hall, Inc. SOME MAJOR REPAIR EQUIPMENT 1. Hydraulic jacks 2. Air compressors 3. Frame gauges 4. Portable body frame and frame straightening equipment 5. Stationary body and frame straightening equipment Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 8

block ii: metals and oxyacetylene welding

General Objectives: To introduce the students to metallurgy and auto body components, oxyacetylene welding and cutting, and the effect of heat on metal.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
II. METALS AND OXYACETYLENE WELDING A. Metallurgy and Auto Body Components The student should be able to:		
1. define metallurgy;	Have the students research library references to aid them in the preparation of a definition of the term metallurgy.	METALLURGY: The technology and science concerned with the production of metals and alloys, their adaptation to use, and their performance in service
2. explain the relationship of metallurgy to auto body repair;	Point out that modern industry and manufacturing would be impossible without the use of metals. Emphasize the use of metals in automobiles and in the tools and equipment for an auto body repair shop. Explain that one branch of metallurgy, physical metallurgy, pertains to the adapting of metals for human use.	ADAPTING METALS FOR HUMAN USE 1. Combining metals 2. Improving metals by heat treatments 3. Forming metals into final shape 4. Treating the surface of metals
3. identify the metals commonly used in auto body manufacturing;	Have the students prepare a list of metals commonly used in the manufacture of auto bodies. Encourage the students to identify non-metallic products used in the manufacturing of the bodies of automobiles/trucks. Relate the metallic and non-metallic products to the components of auto bodies.	METALS USED IN AUTO BODIES 1. Lead 2. White metal 3. Aluminum 4. Copper 5. Steel - low and high carbon - alloyed - mild 6. Cast iron
4. describe the characteristics of metals commonly used in auto bodies;	Discuss the importance of the characteristics of metals to the auto body trade. Have the students prepare reports on the characteristics of metals used in the manufacture of auto bodies. Make the students aware of the non-metallic products used in auto bodies. Have them research and discuss the impact of the non-metallic products on the auto body repair trade.	NON-METALLIC PRODUCTS USED IN AUTO BODIES 1. Plastic 2. Fibreglass 3. Glass glazing 4. Vinyl 5. Other

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
5. Identify and discuss the components of an auto body;	Discuss the components of the body of an automobile. Have the students identify these parts on an automobile and/or on a chart of an automobile.	AUTO BODY COMPONENTS 1. Body Shell 2. Fenders 3. Hood 4. Grill 5. Bumpers 6. Frame 7. Trunk Lid
6. explain the purpose of the auto body components;	Explain the purpose and the importance of each component of an auto body. Locate various models of cars for the students to examine in detail. Ask them to determine if the cars have body-and-frame construction. Point out that body-and-frame construction is the most common and that unibody construction pertains mainly to smaller/compact cars.	Bottom View, Auto Body and Frame Dimension Charts, Rondex Limited Automotive manufacturers' body service manuals Body and Frame Construction, Number AB-G-1 (cassette, filmstrip, worksheet), AIM Educational Aids 1975 Intermediate--Model Body Highlights (super 8 mm, colour), Chrysler Canada Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 2
7. Identify the major causes of damage to the auto body components.	Have the students list the major causes of damage to the auto body components. Refer to damaged automobiles in a school/business auto body repair shop. Introduce the students to the problems associated with the repair of the components so damaged.	MAJOR CAUSES OF DAMAGE 1. Collision 2. Upset/Roll-over 3. Corrosion Damaged automobiles in school/business auto body repair shop Illustrations/photographs of damaged auto body components

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
B. Oxyacetylene Welding and Cutting The student should be able to:		
1. define welding;	Discuss welding. Have the students prepare a definition of welding.	WELDING: Fusing two pieces of metal together through a heat process; a metalworking process by which metals are joined by heating them to the melting point and allowing the molten portions to fuse/flow together; the process of joining pieces of metal by fusing them together with heat
2. recognize the importance of oxyacetylene welding in auto body repair;	Have the students research career and employment opportunities and post-secondary education programs in welding. Review the metals and the characteristics of metals used in the manufacture of auto bodies. Explain the relationship of oxyacetylene welding to metals and their characteristics. Have the students research and identify the uses of oxyacetylene welding in auto body repair. Point out the changing emphasis on oxyacetylene welding in relation to other types of welding. Discuss the influence of technology and of changes in the materials used in auto body manufacture.	USES OF OXYACETYLENE WELDING 1. Welding metal 2. Cutting metal 3. Normalizing metal by heating 4. Shrinking metal 5. Forging/shaping metal 6. Soldering
3. identify and describe the gases and the equipment used in the oxyacetylene welding process;	Discuss gases and equipment by referring to oxyacetylene equipment. Have the students research and prepare reports on the properties and the interaction of the two gases. Ask the students to prepare diagrams of oxyacetylene equipment. Acquaint the students with the following uses of each item of equipment for oxyacetylene welding: a) oxygen cylinder: to store oxygen gas; b) acetylene cylinder: to store acetylene gas; c) oxygen regulator/gauge: to control the flow and pressure of oxygen gas; d) acetylene regulator/gauge: to control	GASES FOR OXYACETYLENE EQUIPMENT 1. Oxygen 2. Acetylene EQUIPMENT OF OXYACETYLENE WELDING 1. Oxygen cylinder 2. Acetylene cylinder 3. Oxygen regulator gauge 4. Acetylene regulator gauge 5. Welding torch 6. Torch tips

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	the flow and pressure of acetylene gas; e) welding torch: to mix the two gases and to provide a handle for directing the flame; f) torch tips: to control the consumption of each type of gas; g) connecting hoses: to carry the regulated gases to the torch; h) protective goggles: to protect the eyes from the heat and glare of the torch's flame; i) lighter: to ignite the gases; j) truck: to hold the cylinders. Have the students explain the function of each item of equipment. Request the students to determine and to list the different types of torches and tips that are available and write down the use of each tip.	7. Connecting hoses 8. Protective goggles 9. Lighter 10. Truck Transparencies/charts/slides of oxyacetylene welding equipment Oxy-Acetylene Welding Equipment, Number C-4A (cassette, filmstrip, worksheet), AIM Educational Aids Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 10 Manufacturers' operating instructions
	Emphasize safety and explain the reason for safety precautions for each step in setting up the equipment.	Auto Body Repair and Refinishing, McGraw-Hill Ryerson, Ltd., Chapter 4
4. list and explain the steps in setting up equipment;	Discuss the steps in setting up equipment for oxyacetylene welding. Explain that cracking the cylinder valves is the process of opening the valves on the cylinders one at a time, to remove dust accumulation, and shutting the valves. During the explanation of the set up, identify and describe the use of the safety devices on the equipment.	SETTING UP EQUIPMENT FOR OXY-ACETYLENE WELDING 1. Secure cylinders to wall/truck/cart. 2. Remove safety caps. 3. Crack the cylinder valves. 4. Connect regulators to cylinders. 5. Connect the hoses to the regulators. 6. Connect hoses to torch body. 7. Insert welding tip. 8. Adjust regulators. 9. Check for leakage. 10. Light the torch. 11. Adjust the flame.
5. set up the equipment;	Demonstrate the sequential steps for setting up the equipment. Point out the importance of	Oxy-Acetylene Equipment Set-Up Procedure, Number C-5A (cassette,

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	practicing the set-up procedure to learn it thoroughly. Provide the students with many opportunities to set up the equipment.	filmstrip, worksheet), AIM Educational Aids
6. turn off the equipment;	Discuss and demonstrate the steps for turning off equipment. Have the students practice the sequential procedures for turning off the equipment. Point out that the steps following Step 2 must be omitted if the torch is to be ignited immediately. Explain that the purposes of Steps 7 and 8 (at right) are to release pressure on the regulator diaphragm and to prolong the life of the unit.	TURNING OFF OXYACETYLENE WELDING EQUIPMENT 1. Close the torch needle valve controlling the acetylene flow. 2. Close the torch needle valve controlling the flow of oxygen. 3. Turn acetylene supply tank valve clockwise to cut off the flow of acetylene. 4. Turn oxygen supply tank valve clockwise to cut off the flow of oxygen. 5. Open the torch needle valve controlling acetylene flow to drain the system. 6. Open the torch needle valve controlling oxygen flow to drain the system. 7. Turn the acetylene regulator adjusting screw counterclockwise. 8. Turn the oxygen regulator adjusting screw counterclockwise. 9. Close both the acetylene and the oxygen torch needle valves.
7. identify and describe the processes for welding sheet and plate metal;	Review the characteristics of metals used in auto bodies. Emphasize safety and safety precautions. List, define, and explain the processes of fusion and braze welding as they apply to sheet and plate metal.	Sheet and plate metal strips for practicing welding FUSION WELDING: The operation in which two pieces of the same kind of metal are made into one BRAZE WELDING: The process of

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		bonding similar and dissimilar metals together with an alloy which melts at a lower temperature than the metals being joined Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc. (Auto body welding chart projects), p. 30
8. use oxyacetylene welding equipment to prepare every type of weld in three positions;	Illustrate, with chalkboard and transparency sketches, the various types of fusion and braze welds in three positions.	TYPES OF FUSION WELDS 1. Fusion weld (bead) 2. Butt weld 3. Lap/fillet weld 4. Tee weld TYPES OF BRAZE WELDS 1. Braze weld (bead) 2. Butt weld 3. Lap/fillet weld 4. Tee weld Oxy-Acetylene Welding, Parts 1 and 2, Numbers C-6A and C-6B (cassette, filmstrip, worksheet), AIM Educational Aids Oxyacetylene Welding (spirit masters, overhead transparencies, super-8 film loops, filmstrips), The Plastic Coating Corporation Illustrations of welds Flame Cutting (16 mm, sound, colour film), Marlin Motion Pictures
9. identify the uses of oxyacetylene cutting;	Explain the uses of oxyacetylene cutting to the auto body trade. Emphasize safety precautions.	USES OF OXYACETYLENE CUTTING 1. To cut bolts

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		2. To cut rivets 3. To cut panel assemblies 4. To cut frame components 5. To cut mangled sheet metal
	Have the students research, identify, and explain the reasons for flame cutting. Point out that body technicians may not like to use a cutting torch to cut sheet metal panels because the heat causes the panels to warp.	REASONS FOR FLAME CUTTING 1. Fast 2. Versatile 3. Inexpensive 4. Only method appropriate to space available.
10. demonstrate the ability to use the oxyacetylene process for cutting;	Identify and assemble the oxyacetylene equipment required for cutting. Have the students practice assembling the equipment. Demonstrate and explain the procedures for cutting bolts, rivets, panel assemblies, mangled sheet metal, sheet metal inner construction, frame and heavy metal. Emphasize correct procedures. Give the students opportunities to practice all of the cutting procedures. Have the students use the cutting process to dissect discarded automobiles for scrap processing.	Illustrations/charts/diagrams for cutting beads of bolts/nuts/rivets and for cutting sheet metal Discarded automobile
	Review and point out the need to observe and practice safety when working with oxygen and acetylene gases.	GENERAL SAFETY PRECAUTIONS WITH OXYACETYLENE EQUIPMENT 1. Wear goggles and protective clothing at all times. 2. Never weld, braze, or heat metal near gasoline tanks, lines, and filler openings. 3. Check equipment before using, to make sure it is in good condition. 4. Never light the torch while it is directed toward supply cylinders or other persons. 5. Stay alert at all times to prevent personal injury and/or property damage. 6. Check the surrounding area for and remove flammable
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GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		materials (cleaning rags, undercoating, paints, insulation, solvents). 7. Protect interior of vehicle from sparks and heat. 8. Use the lighter provided to ignite gases. 9. Follow all rules and procedures presented by the equipment manufacturer and the instructor. Auto Body Repair and Refinishing, McGraw-Hill Ryerson, Ltd., Chapter 7
11. describe the effect of heat on sheet metal; 12. use oxyacetylene equipment to demonstrate the effect of heat on sheet metal.	Emphasize why this information is important to the auto body repair trade. Discuss and show examples of sheet metal subjected to excessive heat. Have the students experiment with making beads and welds on scrap body panels to determine the effects of heat on sheet metal. Following mastery of the processes on scrap body panels, allow the students to practice on real body panels.	

block iii: replacing and repairing damaged panels

General Objectives: To introduce the students to the relationship between auto body components and damage; the procedures for replacing and repairing trunk lids, rear-end panels and front-end panels; and plastic filling and sheet-metal patching techniques.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
III. REPLACING AND REPAIRING DAMAGED PANELS		
A. Auto Body Components and Damage	Make the students aware of career, employment, and post-secondary education opportunities related to replacement and repairing of automobile panels.	1975 Intermediate--Model Body Highlights (super 8mm, sound, colour film), Chrysler Canada 1979 Technical Features--New Yorker, Newport, St. Regis, Omni-Horizon (super 8mm, sound, colour film), Chrysler, Canada
The student should be able to:		
1. recognize the auto body components;	Have the students review the section, Metallurgy and Auto Body Components, on page 21 of this guide.	AUTO BODY COMPONENTS 1. Body shell 2. Fenders 3. Hood 4. Grille 5. Bumpers 6. Frame
2. list the major causes of damage to auto body components;	Review the major causes of damage to auto body components. Explain their relationship to repair procedures and techniques.	MAJOR CAUSES OF DAMAGE TO AUTO BODY COMPONENTS 1. Collision 2. Upset/roll-over 3. Corrosion
3. identify the types of collision damage;	Discuss and have the students bring to class pictures of accidents illustrating front-end collisions, rear-end collisions, and sideswipe collisions. Explain that each of these collisions causes direct and indirect damage. Show the students examples of and have them identify direct and indirect damage on automobiles involved in various types of collisions.	Illustrations/pictures of front-end, rear-end, and sideswipe collisions TYPES OF COLLISION DAMAGE 1. Direct damage 2. Indirect damage Automobiles damaged by collision

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
4. describe the types of collision damage.	Explain how direct and indirect collision damage occur. Emphasize that the point of impact is the point where the damage started and that the force exerted by the impact continues and results in the spread of damage. Have the students practice finding the point of impact and tracing the spread of damage. Encourage the students to visit parking lots/auto body repair shops to examine damaged cars. Ask them to look for examples of direct damage, indirect damage, pressure and tension areas.	DIRECT DAMAGE: Damage caused at the point of impact INDIRECT DAMAGE: Damage occurring away from the point of impact Collision Repair Guide, McGraw-Hill Book Company, Chapter 1 Assessment of Damage, Number 9200 (filmstrips, slides, videotape), AIM Educational Aids
B. Trunk Lid and Rear-End Panel Replacement and Repair The student should be able to:		
1. identify the trunk lid;	Point out that the trunk lid is one of the major sheet metal panels that make up the automobile body. Have the students explain the locations of a trunk lid and list other names for this panel.	OTHER NAMES FOR TRUNK LIDS 1. Rear deck lid 2. Rear compartment lid 3. Compartment lid
2. explain the construction of the trunk lid;	Emphasize that the trunk lid is individually constructed and mounted to the vehicle with hinges and has a complex construction consisting of an inner and an outer panel. Discuss the purpose of each panel. Emphasize the relationship of fabrication and construction of the trunk lid to the replacement and repair procedures.	Trunk lids for various models of cars
3. describe the procedures for replacing and repairing a trunk lid;	Point out that because of the large number of rear-end collisions, replacements and repairs to trunk lids occur frequently. Review direct and indirect damage. During the discussion and demonstration of the following procedures, identify and explain the purpose of the requisite tools: a) determining the direction of damaging force; b) identifying the location of direct and indirect damage;	Rear Deck Lid Repair, Automotive Sheet Metal Repair series (filmstrips, cassette, instructor's guide), Prentice-Hall, Inc.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	c) locating ridges and channels; d) locating rust damage; e) using tools for removing interfering parts (locking devices, stabilizing bars, and metal covers); f) operating portable pulling and pushing equipment and fixtures; g) connecting attachments for pulling, pushing and holding; h) bump hammering; i) applying heat to severely bent areas.	TOOLS REQUIRED FOR REPAIRING A TRUNK LID 1. Trim removal tools 2. Scrapers, sockets, wrenches, screwdrivers, and pliers 3. Panel holding jigs and fixtures 4. Metal puller and attachments 5. Slide hammer 6. Push and pull ram with fixtures 7. Clamps 8 Suction cup attachment 9. Bumping and body hammers 10. Dolly and spoon 11. Oxyacetylene torch
4. repair a trunk lid;	Demonstrate the procedures for repairing a trunk lid. Explain the auto body vocabulary related to the repair procedures. Give the students time to practice and to perfect the repair procedures. Have the students use a step-by-step approach to repair a trunk lid with the following procedures: unlocking, alignment, roughing, dinging, filing, shrinking, picking, filling. Emphasize safety procedures and safety precautions. Encourage the students to study the shop manual for the car being repaired. Discuss and help students to prepare an estimate for the repairs. Monitor the students' repair and safety procedures and suggest, as necessary, techniques for correcting and improving them.	UNLOCKING THE METAL: The unfolding and reshaping of V channels, valleys, and buckles as gently as possible, without stretching, creasing, or upsetting the metal ALIGNMENT: Adjusting panels or other components to a specified tolerance, as when aligning a door to a fender to gain the correct spacing ROUGHING: The corrective operation of straightening and reshaping damaged metal without stretching, creasing, or upsetting the metal
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GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	Discuss the importance of using the right hammer and dolly to ding out sheet metal. Encourage the students to master, through practice on scrap sheet metal, the two basic techniques: hammer-on-dolly and hammer-off-dolly.	DINGING: Reshaping and levelling out of damaged metal by means of on- and off-the-dolly hammering after the metal has been unlocked and roughed out
	Demonstrate and have the students practice the crossing pattern. Explain that the process of crossing the metal surface in two or more directions reveals the low spots.	FILING: Pushing or drawing a file back and forth over the surface of work in order to detect high and low spots or to wear down a surface to an exact size and shape
	Explain the importance of working fast when heat-shrinking. Point out the necessity of having all requisite tools and materials on hand before starting the process of shrinking.	SHRINKING: A process by which stretched areas on damaged auto body parts and panels are disposed of and brought back, as nearly as possible, to their original shape and size.
	Emphasize the need to be careful when using the pick end of the pick hammer. Indicate that the pointed end can easily punch holes in the metal or push dents in it. Demonstrate and have the students hit the centre of a dent with the point and strike light blows.	PICKING: Raising up low spots with the sharp-pointed end of a pick hammer
	Point out the importance of learning about plastic body filler and how to use it. Explain that there are different types of plastic body fillers on the market. Discuss the importance of trying not to get plastic body filler on the hands and the need for wearing a mask while filing/sanding plastic body filler.	FILLING: A method of repairing inaccessible areas of an auto body by using plastic and/or other types of fillers
5. identify the rear-end panel;	Have the students locate the rear-end panel.	Collision Repair Guide, McGraw-Hill Book Company (Figure A-1), p. 259

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
6. explain the construction of the rear-end panel;	Discuss the purpose and the construction of the rear-end panel. Explain the relationship of the fabrication and the construction of the rear-end panel to the auto body repair procedures.	Rear-end panels for various models of cars
7. describe the procedures for repairing a rear-end panel;	Review direct and indirect damage. Discuss the relationship of the rear-end panel to the trunk lid. During the discussion and the demonstration of the following, identify and explain the purpose of the requisite tools: a) straightening and aligning damaged areas of the panel; b) bump hammering and applying heat to severely bent areas to aid the straightening process; c) working metal with various types of body hammers and dollies; d) welding or brazing patches, tears, and cracks; e) applying heat to shrink stretched areas of the rear-end panel; f) grinding and filing the surface to ensure proper shape of the rear-end panel.	TOOLS FOR REPAIRING A REAR-END PANEL 1. Pushing and pulling equipment and fixtures 2. Dinging hammer 3. Bumping hammer 4. Welding equipment 5. Dollies 6. Square-faced hammer 7. Wedge-shaped hammer 8. Pick hammer 9. Welding equipment 10. Portable disc grinder 11. Body file
8. repair a rear-end panel.	Demonstrate the procedures for repairing a rear-end panel. Give the students time to practice and to perfect the repair procedures. Have the students use a step-by-step approach to repair a rear-end panel. Discuss and assist the students to prepare an estimate for the repairs. Emphasize safety procedures and safety precautions. Emphasize the importance of using correct pressure and angle during the operation of disc grinder/sander. Monitor the students' repair and safety procedures and suggest, as necessary, techniques for	*Collision Repair Guide*, McGraw-Hill Book Company, Chapters 4 and 5 REPAIR PROCEDURES FOR A REAR-END PANEL 1. Apply straightening forces. 2. Prevent stretching of metal. 3. Apply controlled heat to severely bent areas. 4. Work and reshape with dollies and hammers. 5. Weld or braze cuts. 6. Apply heat to shrink metal. 7. Operate a disc grinder/sander to restore original shape to the metal. 8. File to wear down the surface to the exact size and shape.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	improving the procedures.	9. Fill uneven areas with plastic filler.
	Emphasize that the procedures for repairing/replacing rear-end panels make up the main core of the auto body repair trade, and, consequently, the auto body technician will spend much time performing the procedures for repairing/replacing rear-end panels.	
C. Front-End Panel Replacement and Repair The student should be able to:		
1. identify the components of the front-end section;	Discuss and have the students locate all the components in the front end of automobiles.	Front-end sections of various models of cars
2. explain the construction of the front-end section;	Discuss frame and underbody, sheet metal panels, bumper and grill assembly, front-end suspension and steering components. Explain the relationship of the fabrication and construction of the front-end section to the replacement and repair procedures.	
3. describe the procedures for repairing damage incurred during a front-end collision.	Emphasize that the front-end section is more complicated to repair than other major sections of the automobile. Have the students explain the importance of vehicle safety when identifying and using procedures to repair front-end damage. Review direct and indirect damage. During the discussion and the demonstration of the following, identify and explain the purpose of the requisite tools and equipment: a) releasing pressure points on the front-end; b) removing irreparable front-end sheet metal assemblies and parts by unfastening bolts, screws, and other types of retaining hardware by cutting metal at the replacement location; c) aligning, fitting, and installing replacement front-wheel housings, fenders and	TOOLS AND EQUIPMENT FOR REPAIRING FRONT-END SECTION 1. Pulling/pushing devices 2. Power metal cutting tool 3. Hack saw 4. Hammer and chisel 5. Hand shears 6. Cutting torch 7. Clamps 8. Drills and bits 9. Arc welder 10. Portable body straightener 11. Bumping hammer 12. Slide hammer 13. Dollies 14. Welding equipment 15. Portable disc grinder 16. Body file

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	other support structures, by securing with bolts, screws, clamps, tack welding; welding/brazing joints and seams; d) straightening and aligning damaged areas of front sheet metal, applying heat to severely bent areas to aid in the straightening process; e) straightening and aligning damaged areas of front sheet metal using push-pull equipment; f) bump hammering and applying heat to severely bent areas; g) straightening and aligning damaged areas of the hood; h) restoring original shape to damaged areas of the front sheet metal and the hood by working metal with various types of body metal hammers and dollies; i) welding/brazing patches, cracks, and tears, and shrinking stretched metal areas; j) grinding and filing surfaces to insure proper shape of metal. Point out that these procedures form part of the core of the auto body repair trade and that a technician will spend much time repairing and replacing front-end panels. Have the students work on a project related to a car with front-end damage. Explain the estimating procedures and assist the students with the preparation of an estimate for the project.	STUDENT PROJECT 1. Locate a car with front-end damage. 2. Examine the damage. 3. List the steps necessary to repair the damage. 4. Classify the damaged parts as "replace" or "repair." 5. Identify the tools required each of the steps.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
D. Introduction to Filling and Patching The student should be able to:		
1. identify the materials use for filling;	Review the definition of filling. Identify and describe the materials used for removing and filling dents. Emphasize filling with plastic body filler, and make the students aware of other filling methods and materials. Explain that the filling process using a plastic body filler is a cold process.	FILLING: A method of repairing inaccessible areas of an auto body by using plastic and other types of fillers MATERIALS FOR PLASTIC BODY FILLING 1. Plastic body filler 2. Sheet of safety glass/metal/cardboard 3. Putty knife/squeegee with a wide blade 4. Body file 5. Disc sander 6. Hand sander
2. explain the purpose of the plastic filling process;	Point out that the plastic filling process is used to restore damaged sheet metal panels (trunk panels/lids, front-end panels, hoods, etc.) to an approximation of their original contours and to fill seams left when sheet metal has been repaired by welding/brazing or where new metal has been riveted, welded, or brazed on a panel. Mention, when making the decision to fill or not to fill, the importance of considering the whole operation (straightening and adding filler) and the need to decide on the process/es that will do the job well.	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapters 11, 15, 18 Auto Body Repair and Refinishing, 2nd ed., McGraw-Hill Ryerson, Ltd., Chapter 10 Collision Repair Guide, McGraw-Hill Book Company, Chapter 2, pp. 47-51
3. prepare the surface for plastic filler;	Demonstrate and have the students prepare the surface. Discuss the importance of removing wax, oil, and road grime to avoid contamination of bare metal during sanding.	STEPS FOR SURFACE PREPARATION 1. Straighten the metal. 2. Check and correct fit of parts (e.g., trunk lid). 3. Clean surface to remove wax, oil, and road grime.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		4. Sand the surface. 5. Grind the surface to bare the metal.
4. mix and apply plastic body filler;	Demonstrate and/or have the students watch a body technician use the processes of mixing and applying plastic body filler. Have the students record the steps in each operation. Discuss, demonstrate, and have the students practice using and shaping plastic filler to restore damaged metal to original shape/contour. Have the students begin practicing plastic filling on created damage or actual damage in any practice metal panel. Following mastery of the process have the students use plastic filling as required in the shop projects. Emphasize and have the students follow the necessary safety precautions. Point out the importance of following label directions on cans/bottles/other containers to the letter.	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 18 The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., Chapter 8 Plastic Filler Repair, Number AB-J-3A (cassettes, filmstrips, worksheets), AIM Educational Aids Using Fillers: Lead and Plastic, Autobody Repair: Metal Work series (filmstrip, cassette, instructor's guide), Prentice-Hall, Inc.
5. identify the materials used for patching;	Identify and describe the materials used for patching various areas of an auto body. Emphasize patching with sheet metal and make the students aware of other patching materials.	PATCHING MATERIALS 1. Flat sheet metal 2. Fibreglass 3. Vinyl repair patching compound
6. explain the purpose of patching with flat sheet metal;	Point out the use of flat sheet metal in the patching process to repair small areas of panels severely damaged by tears, holes, and rusting.	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 15
7. apply a sheet metal patch.	Demonstrate and allow the students practice time for the application of sheet metal patches. Explain that a patch made from discarded scraps or from flat sheet metal purchased for patch work may be riveted, spot- or arc-welded, or brazed into place. Point out the advantages and disadvantages of the various methods of applying a sheet metal patch in relation to the shape of the area.	

block iv: introduction to paint preparation

General Objectives: To familiarize the students with the supplies, tools and equipment for painting; procedures for surface preparation; techniques for selecting paint and for applying masking; and the procedures for dismantling, assembling, caring for and maintaining a suction feed spray gun.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
IV. INTRODUCTION TO PAINT PREPARATION		
A. Preparation for Painting	Have the students research the career, employment, and post-secondary education opportunities related to painting and the auto body repair trade.	
The student should be able to:		
1. identify the paint supplies, tools, and equipment;	Emphasize that an auto body repair technician requires a knowledge of tools and equipment for automotive painting. Acquaint the students with the various types of supplies, tools, and equipment for painting. Have the students prepare lists identifying the supplies and their major uses. Request the students to prepare an inventory of each of the various paint supplies available in the school shop. Explain that the supplies come in many sizes and that each supply serves a special purpose. Make the students aware that in addition to a spray gun and paint, painting a car surface requires several different types of painting supplies and the use of some special equipment.	Displays/charts of paint supplies, tools, and equipment SUPPLIES FOR PAINTING 1. Cloth and paper towels 2. Tack rag 3. Masking tape and paper 4. Sandpaper 5. Paint paddle 6. Paint strainer TOOLS AND EQUIPMENT FOR AUTOMOTIVE PAINTING 1. Sanding blocks 2. Power sander 3. Power polisher 4. Spray guns 5. Compressors 6. Spray booth
2. list reasons for refinishing;	Emphasize that refinishing is a very important phase of auto body repair. Have the students identify and discuss reasons for refinishing. Discuss the relationship between the quality of the finished job and the auto body surface preparation. Point out the importance of exercising quality control for mixing and applying paint evenly, rapidly, and thoroughly to painted surfaces of auto bodies and anodized aluminum to match the original or specified colour and appearance.	REASONS FOR REPAINTING 1. Completing repair of damage 2. Changing the colour 3. Restoring a faded/deteriorated finish 4. Enhancing the appearance and value

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
3. explain the process of preparing the outer surface of the vehicle;	Identify and describe the various steps and procedures related to preparing the outer surface of an automobile for refinishing. Emphasize the need to analyze carefully the surface to be refinished. Have the students begin with the simplest task and proceed toward the more complicated.	SURFACE PREPARATION PROCEDURES 1. Analyze surface 2. Clean 3. Sand 4. Featheredge 5. Prime 6. Putty 7. Resand 8. Reprime 9. Resand 10. Wash chemically 11. Seal before final coat Collision Repair Guide, McGraw-Hill Book Company, Chapter 6 Auto Body Repair and Refinishing, 2nd ed., McGraw-Hill Ryerson, Ltd., Chapter 14
4. choose and use appropriate cleaning procedures;	Identify and discuss the procedures for removing grime, grease, wax, and polish. Give the students opportunities to practice cleaning procedures.	Autobody Repairing and Repainting, The Goodheart-Willcox Company, Inc., Chapter 26
5. identify and describe abrasives for surface preparation;	Point out that abrasives are available in a variety of grit sizes classified by number. Have the students identify the various classifications by listing the types, sizes, and grits available in the auto body shop.	The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., Table 6-1, p. 232 Sanding Techniques, Tools and Materials, Auto body Repair: Refinishing series (filmstrips, cassettes, instructor's guide), Prentice-Hall, Inc.
6. explain and use sanding operations;	Emphasize the importance of choosing the correct types and methods of sanding. Discuss the advantages and disadvantages of and the safety precautions for each sanding method. Demonstrate and have the students practice each method of sanding.	TYPES OF SANDING 1. Hand 2. Power

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		METHODS OF SANDING 1. Dry sanding 2. Wet sanding DRY SANDING: Creating abrasive action without water WET SANDING: Creating abrasive action with special waterproof sandpaper and water Sandpaper and Sanding, Number ABL-I (cassette, filmstrip, worksheet), AIM Educational Aids
7. select and prepare paint;	Discuss the importance of selecting and preparing paint for refinishing. Explain that each type and colour of paint has an identifying number. Have the students locate where the number is mounted in the car. Explain the purpose of and have the students use paint chip books. Point out that wetting the car surface and the chip assists with matching paint during the selection process.	Autobody Repairing and Repainting, The Goodheart-Willcox Company, Inc., Chapter 21 The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., Chapter 17
	Demonstrate and have the students use paint preparation procedures. Refer the students to the direction label on each type of paint container and have them list the safety precautions and the procedures for matching, mixing, and using each type of paint.	Paint Preparation, Number AB-N2 (cassette, filmstrip, worksheet), Prentice-Hall, Inc. Surface Preparation for Repainting, Number ABL-3 (cassette, filmstrip, worksheet), AIM Educational Aids Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 36
8. explain the purpose of masking;	Identify and discuss the two basic purposes of masking.	MASKING: Covering of areas not to be painted

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		PURPOSES OF MASKING 1. Reduction of cleaning time after painting 2. Prevention of primer and paint getting on surfaces other than those to be painted
9. identify masking materials;	Have the students collect information about and prepare a display of the various sizes of masking tape and masking paper. Emphasize the importance of obtaining and using good quality products to reduce the time required for masking and to protect effectively the areas that are not to be painted.	Display of masking materials Masking, Number ABL-2 (cassette, filmstrip, worksheet), AIM Educational Aids
10. apply masking materials;	Demonstrate and give the students time to practice the application of masking tape and masking paper to special areas of a car. Identify precautions to follow while masking.	Auto Body Repair and Refinishing, 3rd ed., McGraw-Hill Ryerson, Ltd., Chapter 14 Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 34 Collision Repair Guide, McGraw-Hill Book Company, pp. 236-238
11. remove masking materials;	Explain and demonstrate the correct procedures for removing masking materials. Discuss the relationship of temperature and paint condition to the removal time and procedures.	The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., Unit 17-3
B. Suction-Feed Spray Gun The student should be able to:		
1. identify a suction-feed spray gun;	Explain that the suction-feed spray gun is the type of gun used most often in the painting area of the automotive shop. Make the students aware of other spray guns used in the automobile industry for painting especially large surfaces.	SPRAY GUN: A device that mixes paint and compressed air to atomize and control the spray pattern as the paint leaves the fluid needle and cap

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		TYPES OF SPRAY GUNS 1. Suction-feed spray gun 2. Pressure-feed spray gun
2. explain the operating principle of the suction-feed spray gun;	Illustrate that the main operating principle of the suction-feed spray gun is to turn liquid paint material into tiny droplets, or spray, and to throw the spray uniformly onto the surface to be painted. Make the students aware that the spray gun is an extremely important piece of equipment for refinishing and that proper care and maintenance are a requisite to producing quality finishes. Discuss and have the students collect information and prepare a report/chart on the advantages and disadvantages of the suction-feed spray gun. Point out that suction-feed spray guns with cups are heavy and difficult to handle, and provide limited control of the spray pattern and rate of paint flow.	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Figures 35-1, 35-4, 35-5, 35-6, pp. 312-313 Auto Body Repair and Refinishing, 2nd ed., McGraw-Hill Ryerson, Ltd., Chapter 16 Display of suction-feed spray guns Transparencies of spray guns Collision Repair Guide, McGraw-Hill Book Company, pp. 212-214 ADVANTAGES OF SUCTION-FEED SPRAY GUN 1. Handles small jobs effectively 2. Facilitates changing from one colour or material to another 3. Cleans easily 4. Operates and adjusts simply and easily Painting Equipment, Number ABN-1 (cassette, filmstrip, worksheet), AIM Educational Aids
3. identify the parts of a suction-feed spray gun and explain their functions;	Locate the parts of the suction-feed spray gun and explain the use of each part. Have the students name and locate the parts of the suction-feed spray gun. Emphasize the importance of becoming thoroughly familiar with the parts of the spray gun. Discuss the uses	Auto Body Repair, Chas A. Bennett Co., Inc., Illustrations 27-16, 27-17, 27-18, 27-19, 27-25, 27-26, pp. 301-302, 305-306

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	of each part as follows: a) internal mix cap--mixes air and fluid inside the cap and delivers the mixture through a hole or slot; b) external mix cap--mixes fluid and air outside the cap at a point about one-half inch from fluid exit opening in the centre of the air cap; c) fluid nozzle and fluid needle valve--control the volume of paint material leaving the gun; d) spray pattern width spread control--allows varying amounts of air to pass through the air horn orifices for controlling the shape of the resulting spray pattern; e) fluid volume control--presets the actual volume of material allowed to leave the spray gun; f) handle portion of spray gun body--allows the painter to hold the gun; g) air supply connection--connects the air supply line directly to the spray gun; h) air-fluid control trigger--controls the air control valve and the fluid needle valve; i) air control valve--controls the flow of air entering the spray gun; j) fluid inlet connection--connects siphon cup/pressure pot to the spray gun; k) siphon cup assembly retainer--attaches the assembly to the spray gun; l) siphon cup release lever--releases the siphon cup by means of hand operation; m) siphon cup--holds the paint; n) siphon tube--allows paint to travel from the siphon cup the spray gun; o) vent port--allows air at atmospheric presure to enter the siphon cup; p) siphon cup seal--forms a seal between the siphon cup and the cover in which the seal is located.	PARTS OF SUCTION-FEED SPRAY GUN 1. Air cap a) internal mix cap b) external mix cap 2. Fluid nozzle 3. Fluid needle valve 4. Spray pattern width spread control 5. Fluid volume control 6. Handle portion of the spray gun body 7. Air supply connection 8. Air-fluid control trigger 9. Air control valve 10. Fluid inlet connection 11. Siphon cup assembly retainer 12. Siphon cup release lever 13. Siphon cup 14. Siphon tube 15. Vent port 16. Siphon cup seal
4. demonstrate the procedures for dismantling and assembl-	Review the parts of the suction-feed spray gun. Provide students with diagrams of the spray gun	Diagram of suction-feed spray gun

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
ling a suction-feed spray gun;	and have them label the parts. During the demonstration of dismantling and assembling the spray gun describe the purpose and the operation of each part. Provide the students with opportunities to dismantle and assemble the parts of the suction-feed spray gun.	Manufacturers' operating instructions
5. clean a suction-feed spray gun;	Review the parts of the suction-feed spray gun. Demonstrate and explain the procedures for cleaning a suction-feed spray gun. Stress the importance of following safety procedures and using proper procedures to clean the gun immediately following use. Point out the relationship between the quality of the spray pattern and the cleanliness of the gun. Explain that procedure #3 (at right) forces air into the fluid passages and pushes the material/paint back into the siphon cup.	PROCEDURES FOR CLEANING A SUCTION-FEED SPRAY GUN 1. Release the siphon cup with the siphon cup release lever. 2. Loosen the air cap. 3. Hold a cloth over the air cap and pull the trigger. Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Figure 35-11, p. 315
	Point out that procedure #4 flushes the fluid passages and removes most of the remaining material/paint. Emphasize the importance of working in a well-ventilated area. Demonstrate the procedure of spraying solvent through the gun while adjusting the fluid volume control for maximum flow.	4. Empty the siphon cup and pour in about one inch of solvent. Use procedure 3 again. 5. Empty siphon cup again and put about one inch of solvent in the cup. Tighten air cap, cleanse the following parts with solvent-soaked cloth: siphon tube, siphon cup seal, and surrounding surface. Attach siphon cup with release lever and spray solvent through the gun. Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Figure 35-12, p. 315
90	Emphasize safety. Explain the importance of	6. Remove air cap from gun,

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	Inspecting all orifices, and if necessary, cleaning them with a wood probe, a toothpick, or a straw from a broom. Caution the students against using metal objects for cleaning orifices. Point out that metal objects will enlarge the orifices and destroy the proper spray pattern.	clean in solvent, and dry with compressed air. Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Figure 35-13, p. 315
	Make the students aware of the need to remove the nozzle periodically to check for build-up of deposits.	7. Inspect fluid nozzle and wipe with solvent-soaked cloth.
	Demonstrate and explain the reassembling steps.	8. Reassemble all parts removed and wipe the exterior of the gun with a solvent-soaked cloth.
	Emphasize the importance of using the oil recommended by the manufacturer.	9. Lubricate the spray gun periodically.
	Show the students the lubrication points.	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Figure 35-14, p. 315
	Have the students practice and perfect the cleaning procedures.	
6. maintain a suction-feed spray gun.	Review the parts of the suction-feed spray gun. Point out that the spray gun is a piece of precision equipment, and consequently should be serviced at regular intervals. Explain the relationship between the frequency of service and the use of the spray gun unit. Demonstrate and have the students practice the basic maintenance procedures.	Use and Care of the Spray Gun, Autobody Repair: Refinishing series (filmstrip, cassette, instructor's guide), Prentice-Hall, Inc. BASIC MAINTENANCE PROCEDURES 1. Remove the trigger pivot screws. 2. Clean material from the trigger pivot screws and the trigger. 3. Put a light coat of white grease on the bearing surfaces at the two screws.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		4. Remove fluid volume control and fluid needle valve. 5. Clean the fluid needle valve and the return spring assembly. 6. Put a coat of white grease on the return spring assembly. 7. Remove the packing for the fluid needle valve.
	Caution the students to replace the packing at finger-tight position.	8. Use light machine oil to soften the packing and replace the packing in reverse order.
	Stress the need to proceed carefully to avoid bending the fluid needle valve.	9. Replace the fluid needle valve and the spring assembly.
	Explain that lubrication of the air control valve packing will prevent the air valve from sticking.	10. Remove the air control valve packing, soften with light oil and replace.
	Emphasize the need to follow the servicing instructions of the manufacturer.	11. Replace the trigger and the pivot screws.
	Allow the students opportunities to practice the maintenance procedures.	

block v: review and introduction to hydraulic power equipment

General Objectives: To review the concepts of Auto Body Repair 103 and to introduce students to hydraulic power equipment.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
V. REVIEW AND INTRODUCTION TO HYDRAULIC POWER EQUIPMENT		
A. Review of Auto Body Repair 103		
The student should be able to:		
1. demonstrate the ability to apply the concepts and skills in Block I: Introduction to Auto Body Repair;	Discuss, review, and give the students opportunities to apply and to use the following: - orientation to the auto body repair program; - historical development of the trade, career, and employment opportunities, and trade ethics;	Curriculum Outline for Auto Body Repair 103 Canadian Classification and Dictionary of Occupations, Department of Manpower and Immigration Canada Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 1
	- safety and shop organization;	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapters 3 and 9 Safety/Health Guide for Industrial Arts, Vocational Industrial, Home Economics, and Business Education, Department of Education Auto Body Safety, Number AB-0-24 (cassette, filmstrips, worksheets), AIM Educational Aids
	- hand and power tools and equipment;	Autobody Repairing and Repainting, The Goodheart-Willcox Company, Inc., Chapters 2, 3 Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 7
	Integrate the basics of auto body repair as required throughout the complete program.	

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
2. apply the concepts and the skills of Block II: Metals and Oxyacetylene Welding;	Review the concepts and skills for metals and oxyacetylene welding prior to instruction on alignment theory and techniques.	
	Discuss and review the following:	Curriculum Outline for Auto Body Repair 103
	- metallurgy and auto body components;	Bottom View, Auto Body and Frame Dimension Charts, Rondex, Limited Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 2
	- introduction to oxyacetylene welding;	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 10
	- operation of oxyacetylene welding equipment; - oxyacetylene welding processes;	Oxyacetylene Welding (spirit masters, overhead transparencies, super-8 film loops, filmstrips), The Plastic Coating Corporation The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., (Autobody welding chart projects), p. 80
	- oxyacetylene cutting; - effect of heat on sheet metal.	
3. apply the theories and demonstrate correctly the procedures of Block III: Replacing and Repairing Damaged Panels;	Review auto body components and damage; types of collision damage; replacement and repair of trunk lid, rear- and front-end panels; and introductory techniques for filling and patching.	Curriculum Outline for Auto Body Repair 103 Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapters 11, 15, 18, 19; Figure 19-4

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		Collision Repair Guide, McGraw-Hill Book Company, Chapters 1, 4-5 The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., Chapters 7-9 Plastic Filler Repair, Number AB-J-3A (cassettes, filmstrips, worksheets), AIM Educational Aids
4. use the skills and apply the concepts of Block IV: Introduction to Paint Preparation.	Summarize and review the following skills and concepts pertinent to painting and auto body repair: supplies, tools, and equipment; refinishing and surface preparation; masking; and dismantling and assembling of a suction-feed spray gun.	Curriculum Outline, Auto Body Repair 103 Autobody Repairing and Repainting, The Goodheart-Willcox Company, Inc., Chapters 24, 26 Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 34 Collision Repair Guide, McGraw-Hill Book Company, pp. 236-238 The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., Chapter 17; Table 6-1, p. 232; Unit 17-3 Paint Preparation, Number AB-N2 (cassette, filmstrip, worksheet), AIM Educational Aids
B. Introduction to Hydraulic Equipment The student should be able to:		
1. identify the types of hydraulic equipment used	Explain and/or have the students locate the meaning of the word hydraulic. Emphasize	HYDRAULIC: Pressure exerted through the medium of a liquid

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	that hydraulic equipment is operated by the pressure on liquid.	Basic Hydraulics (16mm sound colour film), Sperry Rand Corporation Pressure Control Valves (16 mm, sound, black and white film), Sperry Rand Corporation
	Acquaint the students with and point out the relationship of the various types of hydraulic equipment to efficiency in the auto body repair shop. Make the students aware of the relevance of the ever-changing automobile designs to the hydraulic equipment required for repair procedures.	Chart/s/picture/s of hydraulic equipment
2. explain the uses of hydraulic equipment;	Take the students on a tour of the school auto body repair shop and/or arrange field trips to several industrial auto body repair shops and auto supply businesses. Have the students make a list of the various kinds of hydraulic equipment and record the load limit of each and the types of jobs for which the equipment is used. Acquaint the students with the following uses of the various types of hydraulic equipment: - hydraulic body jacks: to raise cars to a desired height to allow the body repair technician to work under the car; - hydraulic floor jacks: to raise a vehicle to the desired height for repairing or replacing panels and accessories;	SOME MAJOR HYDRAULIC EQUIPMENT 1. Hydraulic body jacks 2. Hydraulic floor jacks 3. Portable crane 4. Hydraulic power jack 5. Sheet-metal and frame straighteners 6. Anchor pots 7. Stationary body-frame 8. Hydraulic press Jacks, Hoists, and Crane Safety, Number IA4, (sound filmstrips), AID Educational Aids Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 8 Auto Body Repair, Chas. A. Bennett Co., Inc., Unit 7, Part 2 Auto Body Repair and Refinishing, 2nd ed., McGraw-Hill Ryerson, Ltd., pp. 113-119
	- portable crane: to lift the engine out of the	

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	car and to lift and transport heavy objects; - hydraulic power jack: to raise a vehicle to the desired height for repairing or replacing panels and accessories; - sheet-metal and frame straighteners: to exert a push or a pull on bent sheet-metal or the frame to straighten them;	TYPE OF FRAME STRAIGHTENING 1. Portable 2. Stationary
	- anchor pots: to exert pulls in almost any direction when used in connection with chains and hydraulic equipment;	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Figure 8-11 to Figure 8-14, pp. 68-69
	- stationary body-frame straighteners: to exert pulls in required directions to help move the parts of the car back into shape;	STATIONARY BODY-FRAME STRAIGHTENERS 1. Above-the-floor 2. In-the-floor
	- hydraulic press: to apply high pressure to bent parts to straighten them, to press bushings in or out, to press out rivets, and to straighten bent braces and brackets.	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Figure 8-24, p. 72
3. use hydraulic equipment;	Demonstrate the correct use of hydraulic equipment. Name, show the students how to use, and have the students prepare a list of attachments for each piece of hydraulic equipment. Encourage the students to refer to the equipment manufacturer's operating instructions. Have the students give reasons for and practice safety precautions related to hydraulic equipment. Emphasize, describe, and demonstrate the use of safety stands.	The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., Chapter 4 Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 8 Roughing with the Hydraulic Jack (8mm film loop), Prentice-Hall, Inc.
	Explain and demonstrate set-up steps and pushing, pulling, and clamping procedures related to hydraulic equipment. Give the students opportunities to use hydraulic equipment while working on auto body repair projects.	Manufacturers' operating instructions

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
4. explain and use care and maintenance procedures.	Discuss the importance of using correct care and maintenance procedures to make the equipment last longer and to allow the equipment to give better and more trouble-free service. Discuss, explain and have the students follow general suggestions for taking care of and maintaining hydraulic equipment.	The Principles of Auto Body Repairing and Repainting, 3rd ed., Chapter 4, Unit 4-6, Figures 4-26, 4-36, pp. 149-151 CARING FOR HYDRAULIC EQUIPMENT 1. Avoid overloading rams. 2. Avoid overextending rams. 3. Refrain from tampering with spring-retaining screw at the bottom of the ram. 4. Protect and keep all threads in good condition. 5. Keep oil lines clean and use dust caps when necessary. 6. Adjust off-centre loads frequently. 7. Avoid dropping sharp or heavy objects on and allow clearance for hydraulic hoses. 8. Avoid use of intense heat near hydraulic equipment. 9. Use proper procedures for refilling hydraulic jacks with hydraulic oil. 10. Stress correct insertion of extensions so that the extensions rather than the threaded sections transmit the force.

block vi: body alignment; replacement/repair of panels and electrical assemblies

General Objectives: To give the students opportunities to analyze damaged metal, and to develop replacement/repair skills related to door panels and windows, windshields and rear-windows, interior panels, headlining and other upholstery, fibreglass and electrical equipment.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
VI. BODY ALIGNMENT; REPLACEMENT/REPAIR OF PANELS AND ELECTRICAL ASSEMBLIES A. Analysis of Damaged Metal The student should be able to:		
1. recognize the importance of analyzing damaged metal prior to deciding on replacement and repair procedures;	Emphasize that the best way to plan repairs for damaged metal is to determine exactly what happened. Encourage the students to formulate and use questions for analyzing damaged metal and to trace the accident in slow motion. Have the students mentally reverse the accident in order to visualize how to perform the repair operations.	ANALYZING DAMAGED METAL 1. What was the point of impact? 2. What was the direction of the damage? 3. Does the damaged metal contain some stretched areas?
2. classify conditions of metal damage;	Point out that the various conditions of metal damage occur during impact. Explain that work hardening takes place whenever a sheet of metal bends in the following ways: - metal formed into the shape of a door panel, a trunk lid, etc.; - metal damaged by impact. Explain why it is important for an auto body technician to know at what point the metal panel was hardest and softest before the damage occurred. Discuss and have the students recall the definition of the term direct damage. Encourage the students to find examples of the different types of direct damage by studying illustrations/diagrams of direct damage and/or by inspecting damaged cars of damaged parts of cars.	CLASSIFICATIONS OF CONDITIONS OF METAL DAMAGE 1. Work hardening - normal - created Collision Repair Guide, McGraw-Hill Book Company, Figures 1-1 and 1-2, pp. 5-6 2. Direct damage - tear - gouge - scratch 3. Indirect damage - buckles - pressures

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	Have the students give the definition for indirect damage. Explain, locate, and classify examples of the following types of buckles: simple hinge, collapsed hinge, simple rolled, and collapsed rolled. Encourage the students to determine corrective procedures for each type of buckle.	Collision Repair Guide, McGraw-Hill Book Company, Figures 1-28 to 1-32, p. 19; Figures 1-19 to 1-23, p. 15 4. Direction of damaging force
	Explain the relationship of pressure and tension points to damaged areas in metal panels.	
	Point out that a knowledge of direct damage, indirect damage, and work hardening will aid the auto body technician in determining the direction of the damaging force and in planning repair procedures.	
3. determine the direction of the damaging force;	Explain and have the students discuss clues to be used in determining the direction of the damaging force.	
	Locate pictures and/or actual examples of collapsed rolled buckles to use in explaining that these buckles move away from the point of first contact. Point out that where there are several collapsed rolled buckles, they converge at the point of first contact. Show the students that, in the case of one collapsed rolled buckle, the point of contact is almost at a 90 degree angle to the buckle.	CLUES FOR DETERMINING DIRECTION OF DAMAGING FORCE 1. Collapsed rolled buckles 2. Direct damage marks 3. Pressure points
	Show, with illustrations and/or actual examples, that the direction of damage always ends at the mark created by the impact object.	
	Explain that areas of pressure are on both sides of tension areas and that the side having the greatest pressure shift of metal will indicate the way in which the damage force travelled.	
4. analyze the direction of the damage and the damage conditions.	Give the students pictures of and/or actual examples of damage from which to identify the direction of damage and to classify the damage	Assessment of Damage, Number 9200, (filmstrips, slides, video tape), AIM Educational Aids

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	conditions present. Emphasize the importance to the repair technician of understanding the theories and the analyses of collision damage.	Minor Repair, Number 9203, (filmstrips, slides, video tape), AIM Educational Aids
B. Replacement/Repair of Door Panels The student should be able to: 1. explain the construction of the automobile door;	Emphasize that automobile doors are individually constructed and mounted to the car with hinges. Classify automobile doors and discuss the relationship of door styling and location to the body styles of automobiles. Show the students a diagram or a model of a closed style door assembly and have them label/name the parts of the assembly.	STYLES OF AUTOMOBILE DOORS 1. Closed style 2. Hardtop style CLOSED STYLE: The type of door assembly which encloses the glass with a door header Collision Repair Guide, McGraw-Hill Book Company, Figure 4-1, p. 154 HARDTOP STYLE: The type of door assembly which has no door header and is finished off at the belt line
	Point out the inner construction and outer panels and have the students study the overall construction of the panels for both styles of doors. Explain that the main purposes of the inner construction are to provide strength for the door assembly and to serve as a mount for several components. Show the students that the main purpose of the outer panel is to form the exterior for the inner construction. Describe and show the methods of fastening inner construction and outer panels together. Discuss the importance of understanding the fabrication and the construction of automobile doors in relation to analyzing and making replacements/repairs correctly.	TYPES OF DOOR PANELS 1. Outer panel/door skin 2. Inner construction/door frame
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GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
2. identify the components mounted on the inner door frame;	Show the students a diagram or a model of an inner door complete with components. Have the students identify the components and explain why it is important to fasten an outer panel to an inner frame.	COMPONENTS MOUNTED ON THE INNER DOOR FRAME 1. Window assembly 2. Trim pad and hanger plates 3. Trim pad hanger plate and stabilizer strip 4. Inner door handle 5. Lock assembly 6. Inside locking rod 7. Rear guide 8. Inner panel cam 9. Window down travel bumper support 10. Remote control lock rod 11. Window regulator 12. Lower sash panel cam 13. Remote control handle assembly and escutcheon 14. Window regulator handle 15. Front guide
3. describe the procedures for replacing and repairing the outer panel of a door;	Point out that replacement panels are generally available from car dealers and automotive supply houses. Acquaint the students with and show them how to use manufacturers' shop manuals. Emphasize the need to specify the exact year and model of the car for which the replacement is required.	Manufacturers' shop manuals
	Explain that the outer panels of the door are frequently damaged and consequently require replacement/repair. Review direct and indirect damage. During the discussion and the demonstration of the following procedures, identify the requisite references and tools as listed at the right: a) analyzing direct and indirect damage; b) determining if parts are reparable; c) estimating cost of time and repairs; d) removing door from vehicle, if necessary; e) removing hardware and trim parts; f) straightening door frame and outer door panel to restore original shape and alignment;	Outer Door Panel Replacement, Number AB S-1 (cassettes, filmstrips, worksheets), AIM Educational Aids Bodywork and Painting, The Hearst Corporation, Chapter 3 REPLACEMENT/REPAIR TOOLS 1. Labour flat rate manual 2. Parts catalogue and price list 3. Door removal tools

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	g) removing irreparable outer panel from the door frame by cutting metal and/or detaching spot welds at the replacement location; h) aligning, fitting, and installing replacement outer panel to door frame by securing with clamps, tack or spot welding; i) welding/brazing joints and seams; j) applying plastic body filler/solder where necessary; k) applying sealing material to joints and sound deadener to panel; l) replacing door hinges, windows, channels, regulator, outer handle, moulding, weather seals, interior trim panel, and handles; m) installing and aligning replacement/repaired door; n) installing the striker plate and aligning it to the door; o) testing for dust, water leaks, and wind noise.	4. Trim removal tools 5. Portable body jack 6. Pick and dinging hammer 7. Picks 8. Torch 9. Power metal cutting level 10. Hack saw 11. Hammer and chisel 12. Hand shears 13. Clamps 14. Spot welder 15. Weather sealer and applicator An Analysis Auto Body Mechanic Trade, Department of Manpower and Immigration Canada Body Sealing, (super 8mm, sound, colour film), Chrysler Canada
4. replace/repair an outer door panel.	Demonstrate the procedures for replacing/repairing an outer panel for a car door. Give the students time to practice and to perfect the replacement/repair procedures. Have the students use a step-by-step approach to replace/repair the outer panel. Emphasize safety procedures and precautions.	Outer Door Panel Replacement, Number AB S-1, (filmstrip, cassette, worksheet), AIM Educational Aids Repairing a Door, Automotive Sheet Metal Repair series, (filmstrips, instructor's guide, cassettes), Prentice-Hall, Inc. Collision Repair Guide, McGraw-Hill Book Company, Chapter 4 Canadian Collision Estimating Guide, Mitchell Manuals The Principles of Auto Body Repairing and Repainting, 3rd ed., pp. 91-97, 424-427
	Have the students work on a project related to a car with damaged outer door panel.	STUDENT PROJECT 1. Locate a car with a damaged outer door panel.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		2. Examine the damage. 3. List the steps necessary to repair the damage. 4. Classify the damaged parts as "replace" or "repair." 5. Identify the tools required for each of the steps. 6. Replace/repair the outer door panel.
C. Door Window Replacement The student should be able to:	Point out that in repairing a car, the auto body technician sometimes encounters situations requiring replacement of glass. Make the students aware of the requisite safety precautions in replacing glass.	
1. develop an understanding of the different types of window construction;	Explain that one of the important tasks of auto body work is the replacement/adjustment of door windows. Have the students study illustrations/actual models of the different types of window construction. Draw attention to and have the students identify the two basic types of glass used. Discuss the safety specifications required with both types of glass.	Auto Body Repair and Refinishing, 2nd ed., McGraw-Hill Ryerson, Ltd., pp. 26-28 TYPES OF GLASS 1. Laminated 2. Tempered LAMINATED GLASS: Glass in two layers, with a plastic material in between to prevent shattering TEMPERED GLASS: Glass in one layer tempered with heat to provide additional strength in withstanding the force of impact
2. identify the components of door window assemblies;	Have the students study diagrams or actual door assemblies of several different models of cars. Ask them to point out the differences and similarities. Explain the importance of becoming familiar with the basic operation of the different types of window assemblies before removing the parts.	Auto Body Repair, Chas. A. Bennett Co., Inc., Unit 21

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
3. describe the procedures for replacing door windows;	Review and emphasize safety procedures for replacing door windows. Point out that replacement panels are available from car dealers and automotive supply houses. Acquaint the students with and show them how to use the manufacturers' shop manuals. Emphasize the need to specify the exact year and model of the car for which the replacement door window is required.	Manufacturers' shop manuals Bodywork and Painting, The Hearst Corporation, Chapter 9
	During the discussion and the demonstration of the following procedures, review the components of door window assemblies, and identify and explain the purpose of the requisite tools: a) removing trim assembly and inner water deflector; b) removing the front and rear up-travel stops and lower sash channel cam; c) removing glass run channel outer strip and moulding assembly; d) lifting door window/s and removing assembly; e) checking and servicing window regulator if necessary; f) installing door window/s by following the removal procedures in reverse; g) adjusting the door window/s to proper alignment.	Auto Body Repair, Chas. A. Bennett Co., Inc., Unit 21 The Principles of Auto Body Repairing and Repainting, Prentice-Hall, Inc., Unit 14-3, Chapter 14 Autobody Repairing and Repainting, Goodheart-Willcox Company, Inc., Chapter 19
	Emphasize the importance of becoming familiar with the basic removal replacement procedures and of adapting them as necessary to the different models of window assemblies.	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 25
4. replace door windows.	Demonstrate the procedures for replacing and aligning door windows of various types. Give the students time to practice and to perfect these procedures on different models of cars. Encourage the students to refer to the manufacturers' shop manuals for details on disassembly, assembly, and alignment of all parts. Have the students use a step-by-step approach to replace and align door windows. Request the students to prepare a cost estimate for the replacement work. Discuss and emphasize safety procedures and precautions.	Manufacturers' shop manuals Bodywork and Painting, The Hearst Corporation, Chapter 9

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
D. Windshields and Rear Windows The student should be able to:		
1. Identify and describe the types of construction and installation for windshields and rear windows;	Have the students study the different types of construction used for windshields and back windows. Ask the students to identify and give reasons for the type of glass used in each. Point out to the students the two methods used to install stationary glass panels in automobiles. Have the students view several cars and identify the method of installation used for stationary glass panels. Have the students research references and prepare reports comparing the two methods.	STATIONARY GLASS PANEL: Any glass that does not roll up and down METHODS OF INSTALLING STATIONARY GLASS PANELS 1. Set the glass panel into a rubber channel and mount to the pinch-weld flange. 2. Use a synthetic self-curing rubber adhesive caulking compound which adheres to both the glass and the pinch-weld flange. Rubber Channel Installations, Number ABR-22, (transparency with overlays), AIM Educational Aids
2. explain the procedures for replacing windshields and rear windows;	Point out that the removal and the replacement procedures for windshields and back windows are similar, but that the procedures used may vary slightly for different makes of cars. Explain that technological developments influence the removal and the replacement procedures. Indicate that the replacement of windshields, with and without antennas, and of heated and non-heated rear windows, requires different procedures and safety precautions. Make the students aware of the different sizes and shapes of windshields and rear windows. Encourage the students to view different models of cars to determine the various types of windshields and rear windows.	Auto Body Repair and Refinishing, 2nd ed., McGraw-Hill Ryerson, Ltd., pp. 28-29 Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 28 The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., Chapter 14 Autobody Repairing and Repainting, The Goodheart-Willcox Company, Inc., Chapter 20 Bodywork and Painting, The Hearst Corporation, Chapter 9

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	During the discussion and the demonstration of the following procedures, identify and explain the purpose of the requisite tools and materials as listed at right: a) covering the seats, the dash, and the hood with protective covering; b) removing garnish moldings, inside rear view mirror; and sun visors; c) marking the centre of the windshield and the glass opening; d) detaching air-intake grille, wiper arms, and outside or reveal molding; e) disconnecting windshield type radio antenna and other interfering accessories; f) removing windshields by loosening rubber window channel and by applying physical pressure to inside of glass; g) removing rubber channel from glass and determining if reusable; h) preparing opening and flange for replacement of windshield by cleaning, removing burrs, and straightening flange; i) applying sealing compound to flange; j) installing rubber channel to new windshields; k) installing reveal molding, if applicable, into molding retainment groove of the rubber window channel; l) inserting windshield installation cord into pinch-weld opening; m) positioning the windshield in the opening by using cord and by applying pressure; n) testing for water leaks; o) replacing moldings, windshield wiper blades, sun visors, rear-view mirror, and other accessories, as necessary; p) cleaning glass.	TOOLS AND MATERIALS 1. Cover sheets 2. Molding tools 3. Screw drivers 4. Measuring tape 5. Wiper arm tools 6. Antenna wire tape 7. Wedge tool 8. Rubber mallet 9. Safety goggles and gloves 10. Putty knife 11. Razor blade 12. Sealing compound 13. Rubber channel 14. Reveal molding 15. Draw cord 16. Glass cleaner
	Demonstrate and explain the procedures for removing and replacing adhesive-bonded windshields Describe, compare, and demonstrate the short and extended methods for replacing windshields. Discuss and demonstrate the use of windshield installation kits.	Removing Glued-In Windshield, Number ABH-2A (cassettes, filmstrips, worksheets), AIM Educational Aids

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		Butyl Tape Installations, Number ABR-21 (Transparency with overlays), AIM Educational Aids Installing Glued-in Windshield, Number ABH-2B (cassettes, filmstrips, worksheets), AIM Educational Aids
	Demonstrate and explain the procedures for removing and replacing rear windows. Compare these procedures to those for the removal and replacement of windshields.	Windshield Replacement, Number AB H-1 (cassettes, filmstrips, worksheets), AIM Educational Aids
	Arrange a demonstration in the school laboratory or a field trip to a shop specializing in automotive glass work. Ask the students to watch how the instructors/technicians remove and replace the different types of stationary glass panels. Have the students record the procedural steps and list the tools and materials used during the steps.	
3. remove and replace windshields and rear windows.	Demonstrate and review the procedures for removing and replacing windshields and rear windows. Give the students opportunities to practice and to perfect these procedures on different models of cars and for different types of windshield and rear window installations. Have the students use a step-by-step approach to remove and replace windshields and rear windows. Encourage the students to refer to and to use the automobile manufacturers' body-service manuals, and to submit cost estimates for the replacement of windshields and rear windows.	Automobile manufacturers' body-service manuals

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
E. Interior Trim Panels, Headlining, and Other Upholstery The student should be able to:		
1. identify and define interior trim panels;	Point out that damage may occur to interior trim panels or their removal may be necessary to repair damaged panels, to install glass, and to repair hardware components. Have the student locate and discuss the purpose of interior trim panels.	INTERIOR TRIM PANEL: Inside finish panel on an auto body, as found on doors or cowl panels
2. describe the fabrication of interior trim panels;	Ask the students to examine the interior trim panels to become acquainted with their material and fastening devices. Point out the variety of styles of interior trim panels, types of material, and fastening methods used to attach the interior trim panel to doors. Explain the relationship of their fabrication to the removal and replacement procedures and to the tools required for these procedures.	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Figures 24-1, 24-2, 24-3, 24-4, 24-5, 24-6, pp. 208-210 The Principles of Auto Body Repairing and Repainting, Prentice-Hall, Inc., Chapter 12
3. list the procedures for removing and installing interior trim panels;	Identify and discuss the procedures for removing and installing interior trim panels. Point out that the procedures will have similarities and differences depending upon the model of the car.	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 24, pp. 209-211
4. remove and install interior trim panels;	Demonstrate and review the procedures for removing and installing interior trim panels. Provide practice time for the students to perfect these procedures by using a step-by-step approach, and to prepare cost estimates for these procedures. Emphasize the correct and careful use of the requisite tools.	Automobile manufacturers' body-service manuals
5. identify and define headlining;	Discuss the purpose of headlining.	HEADLINING: Interior trim which covers the underside of the roof panel
6. describe the fabrication of headlining;	Point out the main types of headlining. Have the students locate and classify the head-	

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	lining in several different cars.	TYPES OF HEADLINING 1. Soft--cloth and vinyl-coated 2. Formed--molded
7. list the procedures for removing and installing headlining;	Ask students to examine the various types of headlining and the methods of fastening used. Have them suggest methods for removing and installing headlining. Point out the relationship of the headlining to coat hanger hooks, side rail moldings, sun visors, windshield garnish moldings, back window moldings, quarter trim panels, dome light assembly.	
8. remove and install headlining;	Demonstrate and review the procedures for removing and installing headlining. Emphasize the importance of using tools and procedures applicable to each type of headlining. Give the students opportunities to practice the procedures.	Automobile manufacturers' body-service manuals *The Principles of Auto Body Repairing and Repainting*, Prentice-Hall, Inc., Chapter 12 *Automotive Body Repair and Refinishing*, McGraw-Hill Ryerson Company, Chapter 30
	Arrange a visit to a shop specializing in upholstery. Ask the students to watch how the technicians remove and replace different types of headlining. Have the students record the procedural steps and list the tools and materials and safety precautions used during the steps. Encourage the students to prepare cost estimates for removing and installing headlining.	HEADLINING REMOVAL AND INSTALLATION TOOLS 1. Putty knife 2. Rubber mallet 3. Plastic wedge tool 4. Adhesive applicator 5. Screw drivers 6. Pliers
9. understand/use techniques for replacing/repairing other types of upholstery and interior trim.	Encourage students to research and prepare reports on the repair and replacement on other types of upholstery and interior trim. Discuss and demonstrate the techniques and procedures for replacing/repairing the following: quarter trim panel, quarter upper trim panel, floor-pan insulators, carpet, seats. Have the students work on replacement/repair projects of these types of interior trim and upholstery.	ADDITIONAL TYPES OF UPHOLSTERY AND INTERIOR TRIM 1. Quarter trim panel 2. Quarter upper trim panel 3. Floor-pan insulators 4. Carpet 5. Seats

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
F. Replacement/Repair with Fibreglass The student should be able to:		
1. define fibreglass;	Discuss and define fibreglass.	FIBREGLASS: Fine spun filaments of glass used in insulation and in the bodies of automobiles
2. explain the composition and the characteristics of fibreglass;	Explain the importance of fibreglass in the auto body repair trade. Point out the advantages and disadvantages of fibreglass, and have the students prepare a report, class presentation, or bulletin board display on fibreglass.	ADVANTAGES OF FIBREGLASS 1. Durable 2. Resistant to fire and corrosion 3. Light in weight DISADVANTAGES OF FIBREGLASS 1. Manufacturing with fibreglass is a slow process. 2. Requires special safety precautions. Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 19 The Principles of Auto Body Repairing and Repainting, 3rd edition, Prentice-Hall, Inc., Chapter 9
3. compare the effect of damage on metal and fibreglass parts;	Locate pieces of sheet metal and fibreglass which are similar in shape and size. Damage each piece by hitting with a metal hammer. Have the students explain the differences in the damage. Point out that in the metal piece, the metal crumpled and the force of the damage was transmitted throughout the metal. Show the students that in the fibreglass piece, the damage was localized and that cracks/tears appeared. Point out the implications of these differences for the auto body repair trade.	Autobody Repairing and Repainting, The Goodheart-Willcox Company, Inc., Chapter 14

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
4. Identify tools and materials for replacing/repairing fibreglass;	Show students the tools and materials and explain their purposes. Have the students identify each tool and each type of material. Discuss and have the students research the special safety precautions for fibreglass materials and replacment/repair processes. Explain that working with fibreglass causes less noise than with sheet metal.	Auto Body Repair, Chas. A. Bennett Co., Inc., Unit 18 TOOLS AND MATERIALS FOR REPLACING AND REPAIRING FIBREGLASS 1. Tools - Sander - Electric drill - Hacksaw - Power grinder - Putty knife - C-clamp - Scissors - Screwdriver - Tool for cherry rivets 2. Materials - Cherry rivets - Sheet metal screws - Sandpaper - Paste wax - Cardboard - Plastic film - Fibreglass cloth - Fibreglass bending strips - Epoxy resin, hardener, and filler - Screening wire
5. explain the fibreglass replacement/repair procedures;	Emphasize the importance of following all the safety precautions and the instructions of the manufacturer. Discuss the steps to follow for repairing fibreglass parts. Explain the chemical reaction which takes place in mixing resin and fibreglass.	Auto Body Repair and Refinishing, 2nd ed., McGraw-Hill Ryerson, Ltd., pp. 225-235 REPAIRING FIBREGLASS PARTS 1. Study the damage. 2. Assess the type of repair to be made. 3. Remove the damaged material. 4. Fill the damaged areas with the proper mixture of resin and fibreglass. 5. Allow the activated resin to cure and harden.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		6. Finish and paint the repaired section.
6. repair minor fibreglass damage;	Identify and discuss the minor types of damage. Have the students locate examples of minor damage in various car bodies. Explain and demonstrate the procedures for applying fibreglass cloth to repair various types of minor damage. Emphasize safety precautions. Ask the students to enter in their notebooks a list of the repair procedures and the requisite safety precautions. Point out that using fibreglass cloth allows the auto body technician to do a variety of repair tasks more quickly than using sheet metal methods. Assign the students assessment and repair projects and the preparation of cost estimates for various types of minor damage to fibreglass.	MINOR FIBREGLASS DAMAGE 1. Scratches through paint 2. Pits, small holes, surface cracks 3. Cracked panels Bodywork and Painting, The Hearst Corporation, Chapter 10 Auto Body Repair, Chas. A. Bennett Co., Inc., Unit 18 Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Figure 19-4, p. 173 Autobody Repairing and Repainting, The Goodheart-Willcox Company, Inc., Chapter 14
7. repair/replace major fibreglass damage.	Identify and discuss major fibreglass damage, such as fractured panels. Have the students locate examples of major fibreglass damage. Explain and demonstrate repair procedures required when using fibreglass cloth and mats. Emphasize safety precautions.	FRACTURED PANEL: A panel that has been broken by the penetration of a sharp object Bodywork and Painting, The Hearst Corporation, Chapter 10 Auto Body Repair, Chas. A. Bennett Co., Inc., Unit 18 The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., Chapter 9
	Explain and demonstrate the procedures for partial and complete panel replacement. Outline and demonstrate the steps for using an installation materials kit for replacing a complete panel. Have the students assess major fibreglass damage and repair/replace the fibreglass.	

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
G. Electrical Repair and Replacement The student should be able to:		
1. identify and locate the common electrically operated devices;	Discuss the development of and have the students list and locate electrically operated devices and systems in various models of automobiles. Point out that they are located throughout the vehicle but that many of them are easily controlled by the driver.	INTERIOR-CONTROLLED ELECTRICAL DEVICES 1. Engine ignition 2. Starter 3. Lights 4. Horn 5. Heater 6. Defroster 7. Air conditioner 8. Power antennas 9. Radios 10. Tape decks 11. Power-operated seats and windows
2. collect information about other electrical devices controlled by the body electrical system;	Have the students research and prepare reports on sun-roof motors, open-door warning buzzers, security alarm systems, and the lighting system.	Auto Body Repair and Refinishing, 2nd ed., McGraw-Hill Ryerson, Ltd., Chapter 12 TYPES OF LIGHTS 1. Headlights 2. Tail lights 3. Turn-signal lights 4. Interior lights
3. explain basic electrical concepts;	Discuss the basic concepts of current, voltage, and resistance, and point out their application to automobile electrical circuits.	
4. repair electrical circuits and replace electrical components;	Point out that because electrical circuits and components may be damaged during a collision an auto body repair technician should be able to repair/replace the basic components of the automotive electrical system.	ELECTRICAL REPAIR AND REPLACEMENT DEVICES 1. Wrench and socket set 2. Stripping/crimping tool 3. Soldering tool 4. Headlight adjustment instrument

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		5. Continuity tester 6. Ohm Tester 6. Voltage tester 7. Electric tape
	Acquaint the students with body wire routing and wire identification charts. Use a body wire routing diagram and/or a model to identify the various wiring harnesses. Demonstrate the procedures for repairing electrical circuits and for replacing electrical components. Emphasize the importance of using safety precautions.	Auto Body Repair, Chas. A. Bennett Co., Inc., Figures 25-6 and 25-8, pp. 268 and 269
5. test, remove, install and charge a battery;	Explain that automotive electrical power begins at the storage battery, which provides electrical energy for the ignition and the starter motor. Show the students the alternator and point out that its main purpose is to produce the electrical power for the automobile. Discuss the relationship of the battery and the alternator.	Auto Body Repair, Chas A. Bennett Co., Inc., Figures 25-2a, 25-2b, 25-3, and 25-4, pp. 264-267 Automobile Battery Service, Basic Automotive Service series (filmstrips, instructor's guide, cassettes), Prentice-Hall, Inc.
	Demonstrate and have the students perform the procedures for testing, removing, installing, and charging a battery. Emphasize the requisite safety precautions.	
6. replace damaged light assemblies;	Demonstrate and have the students use the procedures for replacing light assemblies.	Bodywork and Painting, The Heath Corporation, p. 172
7. align headlights.	Discuss methods for aligning headlights. Demonstrate the procedures for headlight alignment. Give the students opportunities to practice and perfect these alignment procedures.	METHODS OF HEADLIGHT ALIGNMENT 1. Machine method 2. Wall method The Principles of Autobody Repairing and Repainting, Prentice-Hall, Inc., Unit 11-5, Figures 11-38, 11-39, and 11-40

block vii: electric welding

General Objectives: To aid the students in developing and practicing skills in electric welding procedures and techniques related to the auto body repair trade.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
VII. ELECTRIC WELDING A. Introduction to Electric Welding The student should be able to:		
1. recognize the importance of electric welding in the auto body repair trade;	Review the types and the characteristics of metals as they apply to the manufacture of auto bodies. Explain the relationship of electric welding to these metals and their characteristics. Point out the main uses and demonstrate the advantages of electric welding.	Auto Body Repair and Refinishing, 2nd ed., McGraw-Hill Ryerson, Ltd., pp. 81-90 Auto Body Repair, Chas. A. Bennett Co., Inc., Unit 10 Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 12 SOME USES OF ELECTRIC WELDING 1. Joining sheet metal panels and sections of panels 2. Reinforcing joints with additional metal to provide strength ADVANTAGES OF ELECTRIC WELDING 1. Takes less time than oxy-acetylene welding 2. Causes less distortion of sheet metal
	Make the students aware of the main disadvantage: some types of electric welding may damage delicate auto body work because of the generation of intense heat.	
2. identify the basic methods of electric welding.	Identify, discuss, and have the students collect information and prepare reports on the basic methods. Point out that the type of work to be done determines the method of electric welding to be used.	BASIC METHODS OF ELECTRIC WELDING 1. Arc welding 2. Spot welding

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		Arc Welding Methods, (16 mm colour film, sound), Miller Electric Manufacturing Company
B. Electric Arc Welding The student should be able to:		
1. define electric arc welding;	Discuss electric arc welding.	ELECTRIC ARC WELDING: Welding which uses electricity as a heat source
2. identify the types of electric arc welding;	Identify and discuss the most common types and the purposes of electric arc welding. Point out that during the process of arc welding, the welder uses an electrode holder, an electrode or welding rod, and a generator that produces an electric current. Explain that shielded-metal arc welding forms an electric arc between the metal and flux-covered electrode and that the heat of the electric arc melts the metal, the electrode, and the flux. Discuss the use of shielded-metal arc welding in the auto body trade. Explain that gas-shielded arc welding involves processes in which the arc and the molten puddle are covered by a shield of inert gas which prevents atmospheric contamination and produces a sounder weld. Discuss the use of MIG and TIG welding in the auto body trade.	TYPES OF ELECTRIC ARC WELDING 1. Shielded-metal arc welding 2. Gas-shielded arc welding - gas metal-arc welding (GMAW or MIG) - gas tungsten-arc welding (GTAW or TIG)
3. identify, describe, and set up the equipment for the various types of electric welding;	Identify the types of equipment and the equipment components for the various types of arc welding. Demonstrate the set-up procedures and have the students set up the equipment. Emphasize the requisite safety precautions. Point out that working safely with "stick," MIG, and TIG welding operations depends upon proper set-up procedures.	Basic Equipment, Arc Welding series (filmstrips, instructor's guide, spirit masters, cassettes), Prentice-Hall, Inc. Electric Welding Safety and Set-up (sound filmstrip), AIM Educational Aids

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	Make the students aware that the type, size, and position of the metals being joined determine the electrode to be used. Emphasize the importance of using a welding shield to protect the face and the eyes from the intense heat and the damaging rays.	EQUIPMENT FOR ELECTRIC ARC WELDING 1. Arc welding unit 2. Leads: - ground lead - lead for connecting the electrode 3. Electrodes 4. Welding shield 5. Protective clothing
4. describe the procedures for shielded-metal arc welding;	Identify and explain the procedures. Have the students record in their notebooks the different types of equipment and the operating procedures for shielded-metal arc welding. Emphasize safety precautions.	The Welding Process, Arc Welding series (filmstrips, instructor's guide, spirit masters, cassettes), Prentice-Hall, Inc.
5. use electric arc welders for shielded-metal arc welding;	Demonstrate the procedures. Emphasize the proper angle of the electrode to the work. To perfect the requisite techniques prior to executing a live weld, have the students practice holding the electrode and moving it along the joint to be welded while the welder is turned off. Give the students opportunities to run beads and to practice making butt and lap welds on various thicknesses of metals. Point out to the students the factors upon which the smoothness and the penetration of the bead depends. Have the students vary these factors during the practice sessions.	Weld Joints, Arc Welding series (filmstrips, instructor's guide, spirit masters, cassettes), Prentice-Hall, Inc. FACTORS DETERMINING THE SMOOTHNESS AND PENETRATION OF THE BEAD 1. Uniformity of the arc 2. Speed of travel 3. Manipulation of electrode while making a weld
6. describe the procedures for gas-shielded arc welding;	Identify and explain the procedures. Have the students record in their notebooks the definitions of MIG and TIG welding, the different types of equipment used for each process, and the operating procedures for each process. Emphasize safety precautions.	Gas Metal-Arc Welding (MIG), (filmstrips, cassettes, and booklets), Winnipeg Welding Supplies, Ltd. MIG Welding (sound filmstrip), AIM Educational Aids

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		TIG Welding (sound filmstrip), AIM Educational Aids
7. make live repairs using MIG and TIG welding.	Demonstrate the procedures. Give the students opportunities to practice running beads and making lap welds on various thicknesses of sheet metal. Have the students apply the skills to the repairing of trunk lids, door panels, quarter panels, and hoods.	
C. Electric Spot Welding The student should be able to:		
1. define spot welding;	Discuss and define spot welding. Have the students collect information about and prepare a report on the uses of spot welding in the auto body repair trade.	Auto Body Repair, Chas. A. Bennett Co., Inc., Unit 10
2. identify the types of spot welding;	Point out that spot welding is a common welding process in an auto body repair shop. Identify the types of spot welding. Have the students research sources of information about and prepare illustrated papers on each of the types of spot welding. Encourage them to visit welding and auto body repair shops and industries specializing in the manufacture of equipment for spot welding.	TYPES OF SPOT WELDING 1. Arc spot welding 2. Metallic inert gas (MIG) spot welding 3. Tungsten inert gas (TIG) spot welding 4. Resistance spot welding
3. identify, describe and set up equipment for the various types of spot welding;	Identify the types of equipment and the equipment components for the various types of spot welding. Demonstrate the set-up procedures and have the students set up the equipment. Emphasize the relationship between proper set-up procedures and safety in spot welding.	SPOT WELDING EQUIPMENT 1. Arc spot welder 2. Metallic inert gas welder 3. Tungsten inert gas welder 4. Resistance spot welder
4. describe the procedures for the various types of spot welding;	Identify and explain the procedures. Emphassize safety precautions.	Resistance Welding: Assembly (sound filmstrip), AIM Educational Aids
5. perform spot welding procedures.	Demonstrate the procedures. Have the students perform the different spot welding techniques	Welding Skills and Practices, 5th ed., American Technical

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	with the available equipment and do research on the processes for which equipment is not available in the school.	Society, Chapter 18 (TIG Spot Welding)

block viii: refinishing and painting

General Objectives: To familiarize the students with refinishing and painting procedures; and to develop techniques for using and maintaining spray painting equipment to complete spot repairs, to paint fenders, doors, deck lids, hoods, and the entire car.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
VIII. REFINISHING AND PAINTING		
A. Refinishing Procedures		
The student should be able to:		
1. list the basic types of auto body repair paint jobs;	Identify and discuss the basic types of paint jobs related to the auto body repair trade. Point out and have the students research the career opportunities in refinishing and repainting cars.	BASIC TYPES OF PAINT JOBS 1. Spot repair painting 2. Panel repair painting 3. Refinishing an entire car
2. identify the auto body skills related to refinishing and painting;	Have the students research, discuss, and list the skills required for refinishing and painting. Emphasize that the final finish depends upon thorough surface preparation and proper paint application.	REFINISHING AND PAINTING SKILLS 1. Masking 2. Sanding - paper selection - handling 3. Selecting and handling thinners 4. Selecting and handling paint 5. Using a power sander 6. Using a spray gun 7. Applying primer-surface 8. Cleaning panels - selecting cleaners - using cleaners 9. Removing masking 10. Rubbing down, compounding, polishing
3. use the refinishing skills covered in Auto Body Repair 103.	Review and provide opportunities for the students to perform the following: sanding, selecting and preparing paint, masking, assembling and disassembling a suction-feed spray gun.	
B. Surface Preparation		
The student should be able to:		
1. identify and describe the surface preparation steps;	Have the students list and explain the steps for preparing the surface of the auto body for repainting. Point out that the procedures	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 37

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	will vary with the kind of paint-repair job and the type of paint on the auto body.	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Part 10 Auto Body Repair, Chas. A. Bennett, Inc., Unit 26 Surface Preparation for Repainting, Number AB L-3 (filmstrip, cassette, worksheet), AIM Educational Aids
2. clean and prepare the surface to be repainted;	Demonstrate and have the students use the procedures for surface preparation. Discuss the purpose of each procedure and the requisite materials. Have the students use an air hose to remove all the dust accumulated on the surface and in the joints. Ask the students why this is an important procedure. Discuss the following purposes for using mild detergent and water: to remove dust and dirt not removable by compressed air; to provide a clear picture of the paint colour for matching; and to enable the masking tape to adhere firmly to the surface. Emphasize the need to use new, clean shop towels or special paint shop towels. Demonstrate as follows: fold a clean shop cloth into a pad; wet the pad with the cleaner; rub the cloth over the area to be cleaned; and wipe the same area with a dry cloth. Point out the importance of this procedure for removing every trace of grease, wax, and/or polish to aid in the adhesion of the new finish. Describe the requirements for good adhesion. Have the students examine the damage thoroughly to decide on the type of repair to be carried out.	The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., Chapter 17 SOME SURFACE PREPARATION PROCEDURES 1. Dust the car thoroughly. 2. Wash the car. 3. Use pre-cleaning solvent. 4. Decide on the type of repair: - spot repair, - panel repainting, - painting complete vehicle.
3. identify and use pre-painting procedures.	Make the students aware of the relationship of the pre-painting procedures to the cleaning procedures and type of repair required.	Paint Preparation, Number AB N-2 (filmstrip, cassette, worksheet), AIM Educational Aids

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	Demonstrate and have the students use the techniques and tools for the following pre-painting procedures: a) checking to determine the satisfactory completion of body repairs; b) removing paint and washing the area with water to neutralize the paint remover; c) removing surface rust and applying metal conditioner; d) feather edging to determine if paint has good adhesion and tapering the surface for every coat of paint; e) applying primer to improve surface and sand; f) removing chemical films from surface; g) applying neutralizer to zinc and galvanized panels; h) applying masking tape and paper; i) applying primer bonding putty and sand; j) applying sealers to old paint and primer; k) grounding vehicle to prevent static electricity; l) removing dust and dirt.	SUPPLIES AND EQUIPMENT FOR PRE-PAINTING PROCEDURES 1. Chemical paint removers 2. Putty knife 3. Orbital sander 4. Featheredging sander 5. Primer surfacers 6. Zinc primer 7. Galvanized metal conditioner 8. Masking dispenser 9. Glazing putty 10. Putty knife 11. Sealers 12. Blow gun 13. Tack rag
	Emphasize safety precautions pertaining to electrically powered tools, trouble lights and extension cords; to the dusting gun; and to potential fire hazards. Discuss the reasons for, demonstrate the use of, and have the students wear personal protective devices.	PERSONAL PROTECTIVE DEVICES 1. Safety glasses 2. Shop clothing/uniforms 3. Goggles and gloves for grinding 4. Rubber gloves for use with corrosive materials 5. Respirators for heavy grinding, stripping, spraying operations 6. Other
C. Paints and Painting Techniques and Procedures The student should be able to: 1. identify the types of paint;	Discuss the influence of technology and scientific research on the types of paint used for	

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	cars. Have the students trace and prepare reports on the history of paints for auto bodies. Mention the special type of paint required for several body parts such as bumpers and the chassis.	TYPES OF PAINT 1. Lacquer - acrylic 2. Enamel - acrylic - polyurethane - water-based acrylic - synthetic
2. list the basic characteristics of each type of paint;	Explain the characteristics of the types of paint. Take the students to the paint room in the school laboratory and/or arrange a visit to an automotive paint supply shop. Have the students read the labels on the paint containers and list the characteristics of each type of paint. Discuss the advantages and the disadvantages of lacquer and enamel.	Auto Body Repair and Refinishing, 2nd ed., McGraw-Hill Ryerson, Ltd., Chapter 13 Bodywork and Painting, The Hearst Corporation, pp. 182-183 Acrylic Lacquer Refinishing, Number AB N-3 (filmstrip, cassette, worksheet), AIM Educational Aids Acrylic Enamel Refinishing, Number AB N-8 (filmstrip, cassette, worksheet), AIM Educational Aids Synthetic Enamel Refinishing, Number AB N-7 (filmstrip, cassette, worksheet), AIM Educational Aids
3. Identify and explain paint ingredients;	Point out that regardless of the type of paint or the manufacturer, all automobile paints have three basic ingredients: pigment, binder, and vehicle. Explain that the lacquer vehicle is called a thinner and the enamel vehicle, a reducer. Emphasize that the lacquer vehicle works only with lacquer and the enamel vehicle works only with enamel.	PIGMENT: Finely ground particles in the paint which give it its colour, durability, and masking quality BINDER: A substance in paint which acts as a glue to bond the pigment particles together and to the painted surface to form a paint film VEHICLE: The liquid portion of paint--solvents, resins, gums,

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		driers, etc. Paint Thinners and Reducers, Number AB L-4 (filmstrip, cassette, worksheet), AIM Educational Aids Paint Ingredients, Number ABP-1 (one of a series of multicoloured transparencies, overlays, instructor's guide), AIM Educational Aids
4. select, match, and mix paint;	Point out that one of the most important tasks in the painting process is the selecting, mixing, and matching of colours. Acquaint the students with the factory codes for colours and the location of the code identification areas in various models of cars. Have the students use these sources of information and collect technical information from reference books and from manuals prepared by the major paint companies. Demonstrate and have the students use the procedures for matching and mixing paint. Emphasize the importance of mixing thoroughly.	Matching Faded Colours, Number ABP-31; Matching Special Colours, Number ABP-32; The Paint Mixing Area; Number ABP-30 (three of a series of multicoloured transparencies, overlays, instructor's guide), AIM Educational Aids
5. collect information about the structure and the purpose of spray booths;	Discuss the structure and the purpose of spray booths. Arrange visits to the school/industrial auto body paint shops. Have the students observe the use and sketch the layout of various spray booths. Point out that auto body shops use the dry type of spray booth and that the air washer type is used in production work. Explain the major reasons for placing vehicles in a spray booth during the painting process. Emphasize the safety features and precautions of spray booths.	SPRAY BOOTH: A compartment, room or enclosure, generally of fire-proof construction built to confine an exhaust overspray and fumes resulting from spray painting TYPES OF SPRAY BOOTHS 1. Dry type 2. Air washer type PURPOSES OF SPRAY BOOTHS 1. To exclude dust during the painting and the drying processes 2. To force out paint odours,

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		to reduce fire hazards. and to improve working conditions by means of exhaust fans
6. identify spray painting equipment;	Acquaint the students with the various spray painting equipment used in the auto body paint shop/area.	Painting Equipment, Number AB N-1 (filmstrip, cassette, worksheet), AIM Educational Aids
7. explain the purpose of spray painting equipment;	Explain the purposes of spray painting equipment as follows: a) air compressor--a mechanical device used to compress air from normal atmospheric pressure to the pressures required to operate various air-operated painting equipment; b) air lines--hoses/pipes/tubes through which air passes c) air transformers/regulators--devices designed for use with spray painting equipment to maintain the pressure of air supply to the spray gun and to prevent oil, dirt, and water from entering the air lines; d) spray guns--tools using air pressure to atomize paint.	SPRAY PAINTING EQUIPMENT 1. Air compressor 2. Air lines 3. Air transformers/regulators 4. Spray guns
8. operate and maintain the air supply system;	Demonstrate the operation of and explain the maintenance of the air compressor, air lines, and air transformers/regulators.	Autobody Repairing and Repainting, The Goodheart-Willcox Company, Inc., Chapter 28 The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., Chapter 16 Auto Body Repair and Refinishing, 2nd ed., McGraw-Hall Ryerson, Ltd., Chapters 15-16
9. identify, operate, and maintain spray guns;	Review the disassembly and the assembly techniques and the maintenance procedures for spray guns. Discuss, define, and demonstrate stroking, triggering, overlapping, banding, and arcing techniques with a spray gun. Have the students practice techniques of spraying	Bodywork and Painting, The Hearst Corporation, pp. 188-189, 192-195 Painting, Number AB N-5 (filmstrip, cassette, worksheet),

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	panels by using water as the fluid. When the students have perfected spray gun techniques by flexing the wrists, hands, and bodies at the proper time, allow them to use paint in the spray gun.	AIM Educational Aids Collision Repair Guide, McGraw-Hill Book Company, pp. 222-224
10. apply paint to spot-repair small areas of a car;	Demonstrate and have the students practice the following spot repairs: a) over fresh or old paint; b) over a metal repair area involving applying putty, filling minor file or disc marks with a heavy primer surfacer, and sanding with a block sander. Explain the purposes of spot painting and blending.	Spot Painting and Blending, Number AB N-4 (filmstrip, cassette, worksheet), AIM Educational Aids Bodywork and Painting, The Hearst Corporation, pp. 180-181, 214-215
11. paint fenders, doors, deck lids, and hoods;	Demonstrate and explain the procedures for painting various types of panels. Discuss the order of the steps for spraying each type of panel. Have the students paint practice panels, apply paint to panel surfaces, and compound and polish paint jobs as required.	The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., Chapter 18
12. paint an entire automobile;	Discuss the need for planning the sequence in painting an entire vehicle. Point out that the plan should minimize the blending required on a panel between coats of paint. Explain the importance of choosing a starting point, moving around the vehicle and spraying in sequence, ensuring the paint supply, and making a final inspection. Arrange a visit to a professional paint shop and watch the procedures being followed by the painter in doing a complete paint job. Have the students record the sequence used.	Final Preparation Before Painting the Entire Automobile, Number AB N-9 (filmstrip, cassette, worksheet), AIM Educational Aids
13. explain the drying process.	Point out the importance of hastening the drying of finishes used in painting automobiles. Identify and acquaint the students with the various types of drying equipment. Explain the use of additives in finishing materials to aid the forced drying process.	TYPES OF DRYING EQUIPMENT 1. Single bulb type 2. Portable infrared panel for spot/panel drying 3. Infrared travelling oven 4. Drive-through type of drying equipment

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	Discuss and have the students research and prepare reports on the different types of drying.	The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., Chapter 16 TYPES OF DRYING 1. Air-drying temperature 2. Force-drying temperature 3. Baking temperature

block ix: theory review, plastic repair, frame and alignment fundamentals

General Objectives: To review the concepts and skills of Auto Body Repair 203; and to introduce the students to plastic repair and to the fundamentals of frames and alignment.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
IX. THEORY REVIEW, PLASTIC REPAIR, FRAME AND ALIGNMENT FUNDAMENTALS		
A. Review of Auto Body Repair 203		
The student should be able to:		Curriculum Outline for Auto Body Repair 203
1. apply the concepts and use the skills of Block V: Introduction to Hydraulic Power Equipment;	Review the types and uses of hydraulic equipment. Have the students demonstrate the procedures for using, caring for, and maintaining hydraulic power equipment.	
2. apply the theories and demonstrate the correct usage of procedures in Block VI: Body Alignment; Replacement/Repair of Panels and Electrical Assemblies;	Review and discuss the analysis of damaged metal; replacement/repair procedures related to door panels and windows, windshields and rear windows, interior panels, headlining, and other upholstery; fibreglass, and electrical equipment.	
3. apply the concepts and use the skills in Block VII: Electric Welding;	Review and discuss electric welding as it pertains to the auto body repair trade; the types, uses, equipment, and procedures of electric arc welding and electric spot welding. Have the students demonstrate the procedures and techniques related to electric welding.	
4. use the skills and apply the concepts of Block VIII: Refinishing and Painting.	Summarize and review refinishing procedures; surface preparation; identification of types of paint; selecting, matching, and mixing paint; and equipment and procedures for spray painting. Have the students use procedures and techniques for spot painting; painting fenders, doors, deck lids, hoods, and entire automobiles.	

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
B. Plastic Repair The student should be able to:		
1. collect information about the use of plastics in the construction of automobiles;	Discuss and have the students research sources of information to prepare a written report/oral presentation complete with illustrations on the use of plastics in automobiles. Have the students make a thorough examination of a late-model car to identify and list the plastic interior and exterior parts. Make the students aware of the impact of plastic on auto body repair techniques and procedures.	Autobody Repairing and Repainting, The Goodheart-Willcox Company, Inc., Chapter 26 Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Figures 20-1 and 20-2, p. 178 SOME EXTERIOR SOFT PLASTIC PARTS 1. Front and rear bumper filler panels 2. Valance and end panels 3. Quarter panel extensions 4. Front and rear bumper upper and lower covers 5. Bumper centre moldings
2. list the three basic types of plastics used for car parts;	Identify and discuss the basic types of plastics used in the manufacture of cars. Point out that many of the plastics used in cars today are made from petroleum.	BASIC TYPES OF PLASTICS 1. ABS plastic (Acrylonite-Butadienne-Styrene) 2. Polyproplene plastic 3. Vinyl plastic
3. identify the main characteristics of the basic types of plastics;	Emphasize the following characteristics of the types of plastic parts: a) polyproplene parts are hard; b) vinyl parts are soft; c) ABS parts are both hard and soft. Point out that the wide use of ABS in the manufacture of hard and soft parts presents a problem of identification.	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 20
4. determine the type of plastic in various automobile parts;	Explain that each type of plastic requires different repair techniques. Emphasize the need to test plastics to identify the type of plastic requiring repair. Demonstrate and have the students perform the tests.	TEST FOR POLYPROPLENE AND ABS PLASTIC 1. Use a sharp knife to remove a small silver of plastic

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	Point out or have the students develop the following conclusions: polyproplene plastic shows no readily visible smoke during burning while ABS burns with visible black smoke.	from a hidden portion of the plastic part. 2. Hold the sliver with tweezers. 3. Ignite the sliver with a match. 4. Observe the burning plastic. 5. Analyze the results to determine the type of plastic.
	Emphasize the need to exercise safety precautions while performing the various burning tests. Make the students aware of the hazards involved in working with plastics.	TEST FOR VINYL PLASTIC 1. Heat a copper wire until it glows and turns red in the flame of a propane torch. 2. Touch the heated wire to a hidden side of the plastic part. 3. Make sure some of the plastic material sticks to the wire. 4. Return the wire with the material to the flame of a propane torch.
	Point out or have the students develop the following conclusions: vinyl plastic burns with a green-turquoise-blue flame.	5. Observe the burning plastic. 6. Analyze the results.
5. explain the plastic repair procedures;	Relate the plastic repair procedures to the type of plastic. Point out that the different types of plastic require different repair materials, techniques and procedures. Assist the students with the development of plans and the submission of estimates for plastic repairs.	PLASTIC REPAIR PROCEDURES 1. Use fibreglass to repair hard parts made from ABS, nylon, Lexan, Noryl. 2. Use vinyl patching kits to repair soft parts made from ABS/vinyl, vinyl tops, interior trim. 3. Use Scotch Weld Structural Adhesive tape or similar patch material to repair other soft plastic materials. 4. Use the hot-air plastic welding technique and procedures to repair thermoplastic materials.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
6. repair soft plastic parts;	Demonstrate and have the students use the procedures and techniques to repair the various types of soft plastic parts.	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, pp. 179-180
7. define hot-air plastic welding;	Explain that hot-air welding is a process used to fuse together and/or repair thermoplastics. Discuss and define the term thermoplastics.	THERMOPLASTICS: Plastics that soften when heat is applied
8. identify, describe, and set up the equipment for hot-air plastic welding;	Identify the types of equipment and the equipment components for hot-air plastic welding. Demonstrate the set-up procedures and have the students set up the equipment. Emphasize the safety precautions for this type of welding.	
9. explain the requirements for good plastic welding;	List and explain the necessary requirements for the welding of thermoplastics. Emphasize the process of fusing materials by the application of heat and pressure.	REQUIREMENTS FOR GOOD PLASTIC WELDING 1. Correct welding rod material 2. Correct temperature 3. Correct pressure 4. Correct angle between the welding rod and the part 5. Correct speed
10. describe the repair sequence for hot-air welding;	Acquaint the students with the steps involved in repairing plastic by the hot-air welding process. Point out the need to bevel the edges, to add another bead of weld, and to re-sand to overcome pinholes/low spots.	STEPS IN HOT-AIR WELDING 1. Prepare the damaged area. 2. Align the damaged area. 3. Weld. 4. Cool. 5. Sand. 6. Paint.
11. repair plastic with hot-air welding;	Demonstrate and have the students use the techniques and the procedures of hot-air welding to repair damaged plastic.	
12. explain and use procedures for painting plastic parts.	Point out that polypropylene parts require special primers before the application of interior acrylic lacquer.	

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	Discuss, demonstrate and have the students use the procedures for painting hard ABS plastic parts. Point out that no primer is required when refinishing hard ABS plastic parts. Emphasize the need to exercise care in applying enough colour to achieve correct hiding and to avoid washout or grain effect.	PAINTING HARD ABS PLASTIC PARTS 1. Wash parts with paint finish cleaning solvent. 2. Apply interior acrylic lacquer or enamel.
	Demonstrate and have the students use the procedures for painting soft vinyl and flexible ABS parts found in the outer cover of some flexible instrument panel cover assemblies and padded door trim assemblies. Emphasize the importance of using a top coat with a gloss level to match the adjacent plastic areas.	PAINTING SOFT VINYL AND FLEXIBLE ABS PARTS 1. Wash parts with vinyl cleaning and preparation solvent. 2. Wipe off cleaner while wet with a clean, lint-free cloth. 3. Apply interior vinyl colour in wet coats. 4. Allow flash time between coats. 5. Apply one wet double coat of vinyl clear top coat before the colour is flashed completely.
C. Frame and Alignment Fundamentals The student should be able to:		
1. identify the frame of an automobile;	Discuss the purpose of and have the students locate the frame of the automobile. Make the students aware that a slight or heavy blow to an automobile may throw the frame out of line.	FRAME: The assembly of metal structural parts and channel sections that supports the car engine and body and is supported by wheels
2. recognize the two types of frame design;	Point out that all automobiles have frames made of steel beams and are designed to provide strength and to improve impact resistance. Illustrate and describe the two types of frame design. Have the students research information about and compare the two types of frame design.	TYPES OF FRAME CONSTRUCTION 1. Conventional body construction 2. Unitized body construction

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		Body and Frame Construction, Number AB G-1 (cassette, filmstrip, worksheet), AIM Educational Aids
3. describe the three types of conventional frames;	Identify, diagram, and describe the three types of conventional frames. Have the students diagram, compare and prepare reports on the three types.	TYPES OF CONVENTIONAL FRAMES 1. Perimeter 2. X-type 3. Ladder
4. describe the types of unitized frames;	Identify, diagram, and describe the various types of unitized frames.	TYPES OF UNITIZED FRAMES 1. Unitized with welded-on frame 2. Unitized with bolt-on stub frame 3. Platform construction
5. explain the relationship of frame construction and damage to alignment;	Emphasize that the auto body repair technician has a responsibility to restore a damaged frame and body to the original condition to ensure the safe operation of the vehicle. Explain the importance of and the reason for aligning the frame and the body before working on the damaged sheet metal. Define and describe the frame alignment process and emphasize that during the process the body and the frame should be aligned together and simultaneously.	FRAME ALIGNMENT: The procedure by which the frame of a vehicle that has been damaged in an accident, or from wear, is restored to the manufacturer's specifications
6. interpret the concept of controlling points in body-frame straightening;	Identify the four controlling points. Point out that the controlling points are reference points for any straightening/aligning operations.	CONTROLLING POINTS 1. Front cross member 2. Cowl cross member 3. Cross member at the rear door area 4. Rear cross member
7. collect information about three sections of the frame;	Diagram the three sections of the frame. Explain that each section is bordered by a cross member or a controlling point. Indicate that hook-ups of straightening equipment should be applied at or near any of the controlling points.	SECTIONS OF FRAMES 1. Front/engine section 2. Centre/passenger section 3. Rear/trunk section

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
8. list the basic types of frame misalignments;	Identify, describe, and diagram the types of frame misalignments. Emphasize the following: a) Sidesway occurs when the front/rear section siderails are bent to the right/left. b) Sag occurs during the buckling of the left/right siderail, or both, upon impact. c) Mash occurs behind the front cross member or over the rear axle. d) Diamond results from heavy impact, strong enough to push the side rail back, on the corner of either side rail of the frame. e) Twist occurs during a collision on a frame carrying a heavy load which causes it to turn over and twist the siderails out of horizontal alignment.	TYPES OF BODY-FRAME MISALIGNMENT 1. Sidesway 2. Sag 3. Mash 4. Diamond 5. Twist
	Emphasize that a severe impact may result in a combination of the basic types of frame misalignments.	
9. diagnose body-frame damage;	Explain that in analyzing an impact-damaged vehicle it is important to determine if the impact has been severe enough to penetrate through the body and the underbody to reach the frame. Have the students make a visual inspection to determine the type of vehicle construction and the extent of the damage. Discuss and show the students how to read and to use the information in the shop manuals available from automotive manufacturers. Give the students opportunities to prepare estimates to repair the body-frame damage. Demonstrate and have the students use the requisite procedures for removing from the damaged car all parts that would get in the way of making a careful diagnosis of the damage to the body and frame.	Checking the Body for Alignment, Number ABR-19 (transparency series, Body Repair and Alignment with overlays), AIM Educational Aids Shop manuals
	Describe and show the students how to use the two basic alignment-checking tools/frame centring gauges. Emphasize the placement of the alignment-checking tools in relation to the controlling point. Point out that the purpose of these tools is to diagnose the damage	TYPES OF ALIGNMENT CHECKING TOOLS 1. Rigid frame centring gauges 2. Alignment-checking tool with chains and pendants with vertical rods

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	present in the frame.	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 16
10. prepare the car for straightening;	Explain that even though all collision jobs are not the same, certain sequential steps are generally required to prepare cars with frame construction and unitized bodies for straightening. Demonstrate and have the students practice using the steps.	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, pp. 147-148 The Principles of Auto Body Repair and Repainting, Prentice-Hall Inc., p. 283 Auto Body Repair and Refinishing, 2nd ed., McGraw-Hill Ryerson, Ltd., Chapter 9
11. straighten the body and the frame and restore the alignment;	Explain that these are frequent duties of auto body technicians, and that in most motor vehicle collisions the technician must be able to detect vehicle frame and underbody problems, and with up-to-date equipment must be able to rectify most damage in this category.	
	Emphasize the need to bring the body and the frame back to the manufacturer's specifications. Discuss, acquaint the students with, and have them use the following sources of information in manufacturer's shop manuals: frame blueprints giving frame reference points; datum line checking giving datum line vertical measurements; tables of factory tolerances for frame adjustment.	Shop manuals Frame Damage Analysis and Correction, Number AB M-1 (filmstrip, cassette, worksheet), AIM Educational Aids
	Emphasize that body-frame damage must be removed in the opposite direction from that of the impact. Demonstrate and have the students use the following procedures for straightening the body and the frame and restoring the alignment: a) marking the reference measuring points; b) positioning the vehicle frame/underbody in a fixed/portable frame or unitized body straightener/aligner;	Using Body Jack and Frame Machine, Autobody Repair: Metal Work series (filmstrips, cassettes, instructor's guide), Prentice-Hall, Inc. Body/Frame Damage Measurement and Diagnosis, (carousel, slides), Applied Power, Inc.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	c) attaching holding fixtures to the frame and adjusting holding pressure according to the type and the extent of straightening required; d) operating the controls to apply sufficient pulling/pushing pressure to straighten frame, underbody, and unitized body to original shape and dimensions; e) removing irreparable frame, cross members, sub-frame, unitized body parts by unfastening bolts, rivets, and retainment parts; by drilling out spot welding; and by cutting the replacement locations; f) positioning, fitting, and installing replacement frame, cross members, sub-frame, unitized body parts by riveting, bolting, and welding joints and seams.	Bottom View Auto Body and Frame Dimension Charts, Rondex Ltd. STRAIGHTENING AND ALIGNMENT SUPPLIES AND EQUIPMENT 1. Steel measuring tape 2. Marking chalk 3. Stationary/portable body-frame straighteners 4. Pushing/pulling rams 5. Jacks 6. Clamps and hooks 7. Rachet and socket wrenches 8. Drills and bits 9. Hacksaws 10. Hammers 11. Chisels 12. Clamps 13. Riveting tools 14. Electric welder
	Emphasize the following sequence for removing frame damage: diamond damage, mash damage, sag damage, sidesway damage, twist damage.	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 17
	Provide the students with opportunities to practice using portable/fixed frame machines when a damaged car is not available.	Collision Repair Guide, McGraw-Hill Book Company, pp. 120-137
12. explain the theory of wheel alignment;	Discuss the relationship of wheel alignment to body-frame alignment. Point out that the purpose of wheel alignment is to provide for the safe operation of the vehicle and the proper functioning of the wheels.	Shop manuals Wheel alignment trouble chart
13. describe the types of equipment for wheel alignment;	Identify and explain the purpose of each piece of equipment.	The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., Unit 10-5
14. align the wheels of a car.	Demonstrate and have the students follow the alignment procedures.	

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block x: major body damage and collision repair

General Objectives: To give the students opportunities to attain industry-level standards by developing skills and by learning the theory related to front-end, rear-end, and side collision repair, and turret top repair and replacement.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
X. MAJOR BODY DAMAGE AND COLLISION REPAIR A. Front-End Collision Repair The student should be able to:		
1. identify the front-end components;	Have the students list the front-end components. Emphasize the relationship of vehicle safety to front-end damage repair.	SOME FRONT-END COMPONENTS 1. Steering mechanisms 2. Engine compartment 3. Electrical systems 4. Inner panels
2. diagnose front-end damage;	Discuss the need to assess the collision damage before proceeding with repairs. Review and have the students determine the direction of the damaging force or impact and identify the section/parts damaged by direct impact and indirect damage. Following the diagnosis, have the students prepare repair/replacement plans and practice submitting repair estimates.	Auto Body Repair, Chas. A. Bennett, Inc., Unit 14 The Principles of Auto Body Repairing and Repainting, 3rd ed., Unit 15-1 Auto Body: Assessment of Damage (colour-sound filmstrip), Vocational Filmstrip Co.
3. repair the frame and underbody damage;	Review and have the students apply the following frame and underbody repair procedures: a) aligning the frame/chassis; b) pulling out and roughly aligning damaged front-end parts; c) removing directly damaged front-end panels and bright metal parts; d) straightening underbody and inner panels; e) working down high places and raising low areas.	
4. repair damaged front-end sheet metal panels;	Review the procedures and have the students follow these procedures to complete the necessary repairs.	Bodywork and Painting, The Hearst Corporation, Chapter 7
5. install and align repaired and/or new sheet metal panels;	Outline, discuss, and have the students use the correct sequence for installation of parts and alignment of sheet metal parts.	

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
B. Rear-End Collision Repair		
The student should be able to:		
1. diagnose rear-end damage;	Emphasize the need for the body repair technician to make a thorough examination of the rear-end damage before proceeding with the repairs. Review and have the students determine direct and indirect damage. Ask the students to determine the extent of indirect damage to frame and support structure. Following the diagnosis have the students develop repair/replacement plans and practice submitting repair estimates.	The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., Unit 15-4 Auto Body Repair, Chas. A. Bennett, Inc., Unit 15
2. repair rear-end damage.	Discuss the procedures outlined in the repair replacement plans. Have the students use the following steps applicable to the requisite repairs: a) removal of inhibiting parts; b) installation and use of frame gauges to measure damage; c) application of hydraulic corrective force to floor panel, rear body panel, and side rails for the purpose of aligning roughly; d) application of hydraulic corrective force to quarter panels for the purpose of aligning roughly; e) removal of irreparable panels; f) alignment and fitting of doors and trunk lid; g) repairing, welding, and straightening of support structure and quarter panels; h) installation of new/repaired panels; i) finishing seams and irregularities in panels; j) installation of rear bumper; k) water testing the trunk lid.	SOME INHIBITING PARTS 1. Bumper 2. Tail light assemblies 3. Trunk lids Using the Body Jack and Frame Machine, Autobody Repair: Metal Work series (filmstrips, cassettes, instructor's guide), Prentice-Hall, Inc. Aligning Doors, Hoods, and Trunk Lids, Autobody Repair: Metal Work series (filmstrip, cassette, instructor's guide), Prentice-Hall, Inc. Auto Body Repair, Chas. A. Bennett, Inc., pp. 143-144
C. Side Collision Repair		
The student should be able to:		
1. diagnose side collision damage;	Emphasize the need to study and to assess the	The Principles of Auto Body

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	damage thoroughly. Have the students trace direct and indirect damage. Encourage the students to use the assessment information in the development of repair/replacement plans. Give the students opportunities to prepare and submit estimates for side collision repairs.	Repairing and Repainting, 3rd ed., Unit 15-2 Auto Body Repair, Chas. A. Bennett, Inc., Unit 16
2. repair side collision damage.	Assess and discuss the procedures listed in the repair/replacement plans.	
	Have the students use any of the following steps applicable to the requisite side collision repairs: a) securing vehicle by anchoring the side opposite the damaged side; b) removing seats, headliners, floor carpets, and trim panels; c) applying hydraulic corrective force to position roughly the floor section, rocker panel, door pillar and/or roof side rail; d) removing irreparable floor sections, rocker panels, door pillars, and side rails; e) straightening reparable panels and structures; f) installing floor sections, rocker panels, door pillars, and roof side rails. (Discuss and demonstrate the use of the oxyacetylene torch, spot welder, and/or MIG welder); g) finishing seams; h) fitting and installing door assemblies; i) installing trim panels, headliners, floor carpets, and seats; j) air and water testing all openings.	Bodywork and Painting, The Heath Corporation, pp. 156-157 Auto Body Repair, Chas. A. Bennett, Inc., pp. 152-154
D. Turret Top Repair/Replacement The student should be able to:		
1. explain the construction of a turret top;	Have the students examine the turret tops in several models of cars, and research shop manuals and other sources of information to determine how the turret tops are constructed	

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	and mounted to the car. Discuss the importance of understanding the fabrication and the construction of turret tops in relation to the procedures for analyzing and making requisite repairs/replacements correctly.	
2. diagnose turret top damage;	Point out the importance of making a thorough assessment of the damage to the turret top and the related sections of the car before proceeding with repair/replacement procedures. Review and have the students determine direct and indirect damage. Following the assessment of damage have the students develop repair/replacement plans and practice submitting repair estimates.	The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hil, Inc. Auto Body Repair, Chas. A. Bennett, Inc.
3. describe the procedures for repairing a turret top;	During the discussion and the demonstration of the following procedures, identify and explain the purpose of the requisite references and tools: a) removing seats, headlining, trim panels, weather seats, floor mats, windshield, and rear windows;	Curriculum Outline for Auto Body 203
	b) removing reinforcing cross braces by drilling out spot welds;	
	c) taking out insulation by using heat gun/hot air implement. (Emphasize the importance of complete insulation removal for accurate bumping and metal finishing);	Heat gun/hot air implement
	d) applying hydraulic corrective force in the required locations;	Curriculum Outline for Auto Body 203
	e) cross-measuring all openings and the inner car cavity;	The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., Figures 15-38, 15-39, 15-40, pp. 432-434
	f) raising low areas of roof. (Emphasize the importance of starting from the crowned edges and working toward the elastic low crown centre portion);	Hydraulic jack

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	g) picking and filing roof panel to restore the surface to the original contour; h) applying insulating material; i) installing reinforcing cross braces, using a spot welder/MIG welder; j) installing windshield and rear window glass; k) installing and fitting doors into openings; l) installing floor mats, headlining, seats, and trim panels; m) testing doors, windshield, and rear window for sealing against wind noise and water leaks.	Picks, files Spot welder/MIG welder Curriculum outline for Auto Body Repair 203 Body Sealing (super 8mm, sound, colour film), Chrysler Canada
4. repair a turret top;	Demonstrate the procedures for repairing a turret roof. Give the students opportunities to practice and to perfect the repair procedures. Have the students use a step-by-step approach to repair a turret roof. Emphasize safety procedures and precautions.	The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., Unit 15-3
5. describe the procedures for replacing a turret top;	Point out to the students that many of the procedures used for repairing apply to the replacement. Explain the additional procedures required to replace the turret top as one whole unit or assembly.	Manufacturers' shop manuals ADDITIONAL PROCEDURES RELATED TO REPLACING THE TURRET TOP 1. Removal of solder filling from joints with oxyacetylene torch and wire brush 2. Removal of spot welds by drilling 3. Removal of roof panel from frame 4. Straightening, welding, and repairing frame structure 5. Fitting new roof panel to frame structure 6. Welding new roof panel to frame structure
6. replace a turret top.	Demonstrate the procedures for replacing a turret roof. Arrange a visit to a shop to watch how technicians remove and replace a turret top.	

GOALS AND OBJECTIVES	TEACHERS' NOTES AND ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	Have the students record the procedural steps and list the tools and materials and safety precautions used during the steps. Have the students use a step-by-step approach to replace a turret top.	

block xi: shop organization and management

General Objectives: To provide the students with knowledge and opportunities to develop skills in shop organization and layout; to practice procedures related to supply, material, tool and office management; and to practice preparing repair estimates.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
XI. SHOP ORGANIZATION AND MANAGEMENT		
A. Shop Organization The student should be able to:		
1. identify the seven basic operational areas for an auto body repair shop;	Point out that auto body shops differ in size and that regardless of size an auto body shop has seven basic operational areas.	BASIC OPERATIONAL AREAS 1. Office 2. Estimating 3. Metal straightening 4. Painting preparation 5. Painting and drying 6. Storage 7. Rest and locker rooms
2. explain the purpose of each of the areas.	Discuss the functions and the activities related to each of the areas. Have the students sketch the school auto body and label each of the shop areas. Arrange visits to industrial shops and have the students prepare labelled diagrams in their notebooks. Discuss the importance of occupational safety and health standards for each area.	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 9 Auto Body Repair, Chas. A. Bennett, Inc., Unit 34
B. Shop Management The student should be able to:		
1. list the shop management activities;	Identify, discuss, and acquaint the students with the management activities pertinent to the auto body repair trade. Explain the relationship of these management activities to the operation of an auto body repair shop.	MANAGEMENT ACTIVITIES 1. Supply and material management 2. Toolroom management 3. Office management 4. Customer relations
2. explain the purpose of supply and material management; 3. use and maintain a material control system;	Point out the need to keep sufficient supplies and materials for the efficient operation of the shop. Explain the purpose of and have the students design and use material control systems for the school shop. Emphasize the importance of stock rotation, especially as it applies to perishable finishing materials.	Examples of records/forms for supplies and materials

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	Discuss the use of a computer for maintaining a material control system.	
4. explain the purpose of tool room management;	Emphasize the need to maintain a well-organized tool room area, to set up and use an inventory of all tools and equipment. Discuss the importance of checking all tools and equipment against the inventory and of determining a repair and replacement plan for damaged and obsolete tools.	The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., Chapter 21
5. maintain tools, equipment, and tool room;	Integrate the maintenance of tools, equipment, and tool room throughout the Auto Body Repair program. Give the students opportunities to initiate a maintenance program for tools and equipment.	
6. identify the office management functions;	List and discuss the office management functions in the operation of a business.	SOME OFFICE MANAGEMENT FUNCTIONS 1. Recording overhead costs - rent/mortgage - advertising - light/power/heat - insurance/taxes - licences - office supplies 2. Maintaining personnel records - file of employees - payroll records and preparation 3. Keeping accounting records - financial statements - preparation of budgets
7. explain the purpose of and the procedures for the office management functions;	Discuss each of the functions. Acquaint the students with the business forms and procedures. Give the students opportunities to use the business forms. Have them make a collection of business forms used in auto body shops. Discuss the use of the computer for office management functions.	
8. identify the need for and the importance of customer relations;	Discuss and have the students list activities and procedures involving contact with customers. Point out that the customers make up the business.	

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
9. list ways of building and maintaining good customer relations;	Have a brainstorming session to determine ways to build and maintain good customer relations.	*Auto Body Repair*, Chas. A. Bennett, Inc., pp. 388-390
10. describe and use procedures for good customer relations.	Explain and have the student prepare a report on the components of good customer relations. Give the students frequent opportunities to use the procedures and to accept the responsibilities for good customer relations in the school auto body repair shop.	BUILDING AND MAINTAINING GOOD CUSTOMER RELATIONS 1. Greet customers promptly and in a friendly way. 2. Use friendly and efficient telephone manners. 3. Diagnose problems accurately. 4. Prepare well-written itemized cost estimates. 5. Explain the repair procedures. 6. Adhere to time schedules. 7. Perform the work effectively and efficiently. 8. Provide prompt service. 9. Handle grievances professionally. 10. Express appreciation. 11. Maintain well-organized and clean shop and grounds.
C. Estimating Procedures The student should be able to:		
1. explain the purposes of estimating;	Point out that the preparation of estimates is an important aspect of and a highly specialized task in the auto body repair trade. Discuss the purposes of estimates.	PURPOSES OF ESTIMATES 1. To establish the cost of repair before the work is started 2. To provide a guide for repair operations 3. To provide an agreement for repair work 4. To establish a basis for good customer relations 5. To build a business reputation
2. identify and describe the types of estimates;	List and discuss the types of estimates.	TYPES OF ESTIMATES 1. Courtesy estimate

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		2. Competitive estimate 3. Noncompetitive estimate
3. compare the types of estimates;	Explain the characteristics and the purposes of each type of estimate.	Collision Repair Guide, McGraw-Hill Book Company, Chapter 7
4. identify and use the information sources for estimates;	Point out that there are several sources of information to assist with the preparation of estimates. Give the students opportunities to practice using the reference materials to prepare estimates on cars in the auto body shop. Make the students aware of, and/or have them use, computer information banks.	Canadian Collision Estimating Guide, Mitchell Manuals, Inc. ESTIMATES INFORMATION SOURCES 1. Estimation (educated guess) 2. Manufacturer's flat-rate book 3. Manufacturer's parts price book 4. Collision estimating book 5. Computer information banks
5. collect information about estimating forms;	Prepare bulletin board displays of and have the students collect information about estimating forms.	Work order forms Estimate of repair forms
6. explain the estimating procedures;	Describe and have the students follow the estimating procedures. Point out the importance of identifying parts, obtaining the cost of new and used parts, listing labour costs and costs for sublet items. Arrange visits to body shops to provide the students with opportunities to watch estimators working. Have the students prepare notes on the time for metal straightening and the costs of paint, material, and refinishing times.	Collision Repair Guide, McGraw-Hill Book Company, p. 255 The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., Unit 21-2 Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 40
7. prepare estimates.	Explain, demonstrate, and have the students prepare several estimates.	Estimating Autobody Damage, Autobody Repair: Metal Work series (filmstrip, cassette, instructor's guide), Prentice-Hall, Inc.

block xii : advanced refinishing and painting

General Objectives: To use and to practice the procedures, and to apply the theories of advanced refinishing and painting to attain a level of proficiency suitable to industry.

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
XII. ADVANCED REFINISHING AND PAINTING		
A. Review and Introduction to Advanced Refinishing Procedures		
The student should be able to:		
1. use the surface preparation skills from Block VIII: Refinishing and Painting (Auto Body Repair 203);	Review and have the students use the skills for surface preparation and the identification and use of prepainting procedures.	Curriculum outline for Auto Body Repair 203
2. demonstrate the use of knowledge and skills about painting from Block VIII: Refinishing and Painting (Auto Body Repair 203);	Review and have the students apply their knowledge of the types, characteristics, ingredients, selection, matching and mixing of paints; the operation and maintenance of spray booth, spray painting equipment, and spray guns; and the application of paint to spot-repair small areas of a car, to paint fenders, doors, deck lids, hoods, and an entire automobile.	Curriculum outline for Auto Body Repair 203 ABC's of Spray Equipment, The DeVilbiss Company (free)
3. appraise the readiness of the body surface for painting;	Discuss the need for the body repair technician/the students to assess the body surface to determine the condition of the body finish before proceeding with painting. Emphasize the importance of grounding the vehicle to prevent static electricity, of removing dust and lint with a blow gun and a tack rag, and of maintaining correct temperature in the paint booth for various types of paint.	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 37 Automotive Refinish Manual, The 3M Company
4. choose paint appropriate to the type of body material;	Point out that different types of body material (metal, alloy, plastic, polyester, fibreglass) may require different types of paint. Following the appraisal of the surface and the choosing of the paint, have the students prepare painting plans and practice submitting estimates.	Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapters 36, 38 The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice-Hall, Inc., Chapters 17, 19
5. prepare lacquer paint for spraying;	Explain and have the students follow these procedures to prepare lacquer paint for spraying:	The Principles of Auto Body Repairing and Repainting, 3rd ed.,

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	a) mixing and tinting the lacquer to match the colour of the vehicle; b) thinning the lacquer to obtain the proper viscosity for spraying; c) measuring and mixing the requisite additives to the lacquer; d) straining paint and filling the spray gun.	Prentice-Hall, Inc., Unit 17-2 Paint Shop Manual, E. I. DuPont de Nemours and Co. (free)
6. apply lacquer paint;	Review, demonstrate, and have the students use the correct application techniques. Emphasize the following procedures: a) adjusting the air pressure and the spray gun; b) spraying at the distance to achieve the requisite film thickness and wetness of the lacquer; c) allowing the drying time necessary between coats of paint; d) manipulating the spray gun to blend the paint properly.	Collision Repair Guide, McGraw-Hill Book Company, Chapter 6 Auto Body Repair, Chas. A. Bennett Co., Inc., Unit 29 Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 38
7. use post-painting procedures to finish the lacquer surface;	Demonstrate and have the students practice and use the following post-painting procedures: a) removing masking tape while lacquer is wet; b) polishing newly applied lacquer after allowing sufficient drying time; c) applying a clear protective urethane coating.	Collision Repair Guide, McGraw-Hill Book Company, Chapter 6
8. prepare enamel and synthetic paints for spraying;	Explain and have the students follow these procedures to prepare enamel and synthetic paints for spraying: a) determining that the temperature of the paint is correct for mixing and applying; b) mixing and tinting the paint to match the colour of the vehicle; c) thinning the paint to obtain the proper viscosity for spraying; d) filling the spray gun.	Auto Body Repair, Chas. A. Bennett Co., Inc., Unit 30 Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 38
9. apply enamel and synthetic paints.	Review, demonstrate, and have the students use the correct application techniques. Emphasize the following procedures: a) adjusting the air pressure and the spray gun;	Collision Repair Guide, McGraw-Hill Book Company, Chapter 6

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
	b) spraying at the distance to achieve the requisite film thickness and wetness; c) allowing the necessary drying time between coats of paint; d) allowing additional flash-off time when spraying coats of enamel on fibreglass surfaces.	Automotive Refinishing Principles and Techniques, E. I. DuPont de Nemours and Company Repaint Manual, Ditzler Refinish Division, PPG Industries, Inc.
B. Paint Problems and Failures The student should be able to: 1. Identify paint problems;	Point out that difficulties do occur during lacquer and enamel refinishing and can happen with almost any paint job. Have the students examine cars/parts of cars to locate as many paint problems as possible.	Paint Faults and How to Correct Them, Autobody Repair: Refinishing series (filmstrips, cassettes, instructor's guide), Prentice-Hall, Inc. Automotive Body Repair and Refinishing, McGraw-Hill Book Company, Chapter 39 The Principles of Auto Body Repairing and Repainting, 3rd ed., Prentice Hall, Inc., Unit 19-11 Autobody Repairing and Repainting, The Goodheart-Willcox Company Inc., Chapter 29 Auto Body Repair and Refinishing, 2nd ed., McGraw-Hill Ryerson, Ltd., pp. 316-318 TYPES OF PAINT PROBLEMS 1. Bleeding 2. Blisters, bubbles, pop-ups 3. Chalking, dulling 4. Chipping 5. Colour mismatch mottle 6. Cracking, checking 7. Craters, fisheyes 8. Dirt in paint 9. Foreign material on surface 10. Industrial fallout

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		11. Lifting 12. Metal-finishing marks/sand scratches 13. Molding installation damage/rust 14. Orange peel 15. Overspray 16. Peeling 17. Poor drying/hardness 18. Rusting 19. Sags/Runs 20. Scratches 21. Sealer, deadener under paint 22. Stains, tarnish, fading 23. Thin paint, no paint 24. Water spotting 25. Wrinkling
2. define the various paint problems;	Discuss and point out the characteristics of each type of paint problem. Have the students list the paint problems and provide a definition of each in their notebooks. Ask the students to research sources of information and prepare reports on the various paint problems.	PAINT PROBLEMS 1. BLEEDING: The appearance of an old colour coming through and colouring a fresh topcoat of paint 2. BLISTERS, BUBBLES, POP-UPS: Small bubbles that form in a paint film
3. explain the causes of paint problems; 4. describe prevention techniques;	Point out that there are many different causes and many methods of preventing paint problems. Emphasize that if the surface to be refinished had been properly prepared prior to painting, many of the problems would not have occurred. Have the students list the causes of the paint problems and prepare reports on prevention techniques for each type of problem.	3. CHALKING, DULLING: The presence of loose, powdery pigment which is no longer held to the surface by the binder and which causes the finish to appear dull 4. CHIPPING: Damage resulting from the impact of a sharp object which removes some of the finish 5. COLOUR MISMATCH: Adjacent areas that do not match 6. CRACKING: A break in the paint film which extends down to the metal surface or the undercoat 7. CRATERS: Holes in the paint

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		film caused by paint flowing away from contamination spots before it dries 8. DIRT IN PAINT: Foreign material under or in a paint finish 9. FOREIGN MATERIAL ON SURFACE: Contamination such as oil, grease, road tar, insecticides, on paint film surface 10. INDUSTRIAL FALLOUT: A condition caused by particles being blown into the air by various processes of heavy industry and being deposited on the surface of a vehicle 11. LIFTING: A condition in which a refinish paint is applied over a paint coating, causing the original coat to separate from the surface to which it was applied
5. choose procedures to correct paint problems;	Discuss and have the students match correction procedures to the various paint problems. Explain that it is much easier to take extra care to prevent the problems than it is to remedy them. Emphasize that until the body repair technician/students can identify the paint problem and what caused it, it is difficult to choose and to use corrective procedures. Following the identification of corrective procedures, have the students prepare plans for correcting the problem and practice submitting estimates.	12. METAL-FINISHING MARKS: The result of poor surface preparation techniques, such as gouging by coarse grinder disks or files, poor sanding, or the use of too coarse a sandpaper 13. MOLDING INSTALLATION DAMAGE: A specific kind of scratching or chipping of the paint finish adjacent to or underneath bright moldings or ornaments 14. ORANGE PEEL: A rough texture in the paint resembling the skin of an orange, caused by the failure of sprayed paint film to flow evenly

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		15. OVERSPRAY: Droplets of paint from a spray gun that fall on areas where they are not wanted 16. PEELING: The separation of a paint film from the surface to which it has been applied 17. POOR DRYING: Describes the occurrence of softness in a film of paint when it should be harder 18. RUSTING: A condition resulting from weathering of exposed or insufficiently protected or prepared metal 19. SAGS/RUNS: A paint film that drips or runs because of applying too much paint
6. use procedures to correct paint problems.	Explain, demonstrate, and have the students use the requisite procedures. Emphasize safety precautions.	20. SCRATCHES: Metal-finish marks, usually caused by poor surface preparation techniques 21. SEALER UNDER PAINT: Types of dirt under paint because of poor prepaint/cleanup operations 22. STAINS: The result of surface contamination which has affected the colour of the finish 23. THIN PAINT: A condition in which not enough paint has been applied or an excessive amount has been removed by abrasion or erosion 24. WATER SPOTTING: Damage caused by exposing to snow, rain, or dew a new paint film that has not completely dried 25. WRINKLING: Skinning of a thick or heavy coat of paint before the underpart of the

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
		film has properly dried, resulting in wrinkles
C. Special Finishes and Custom Painting The student should be able to:		
1. recognize the relationship of custom painting to the auto body repair trade;	Point out the importance of special effects in auto body refinishing. Explain that an auto body repair technician may produce a variety of special effects by using various combintions of materials and application techniques.	Auto Body Repair, Chas. A. Bennett Co., Inc., Unit 31
2. identify and describe the equipment and materials for painting special effects;	Show the equipment and materials or illustrations of each to the students and explain their purposes. Have the students identify each piece of equipment and each type of material. If the equipment and materials are not available in the school shop, have the students research the literature and prepare illustrated reports or arrange a field trip to an industrial shop which specializes in custom painting.	EQUIPMENT AND MATERIALS FOR PAINTING SPECIAL EFFECTS 1. Spray gun with two siphon cups 2. Touch-up-size spray gun 3. Air brush with assorted containers 4. "T" connection 5. In-line regulator with gauge 6. Striping tool and accessories 7. Striping brushes 8. Squeegee bottles 9. Masking material 10. Special scissors and knives 11. Special lighting 12. Acrylic lacquer (clear and metallic, candy, pearl shades) 13. Thinners 14. Primer surfacer, sealer, and base coat material 15. Flake material in a variety of colours 16. Metallic foils 17. Selection of prepared flake designs 18. Selection of crushed glass or glass flake

GOALS AND OBJECTIVES	TEACHERS' NOTES AND SUGGESTED ACTIVITIES	REFERENCE AND SUPPORT MATERIAL
3. describe the custom finish procedures;	Discuss and use illustrations to explain the processes involved in producing some of the special effects. Have the students collect information about and prepare in-depth reports on some of the special effects in which they are interested. Prepare a bulletin board display or a set of slides/posters about custom painting.	CUSTOM FINISH PROCEDURES 1. Ribbon painting 2. Fish scale 3. Card masking 4. Cobweb 5. Crazed finish 6. Lace effect 7. Splatter drops 8. Stencil painting 9. Spaghetti 10. Metallic foil process 11. Flame effect 12. Freehand brush stripping 13. Spray gun mural 14. Painting vans 15. Smoke effect
4. explain masking procedures for custom painting;	Discuss, demonstrate, and have the students use some of the special masking procedures.	
5. create and use a design or several designs for painting special effects.	Encourage the students to create and us a design or several designs for painting special effects. Caution the students to observe safety precautions when doing special finishing and custom work on vehicles.	

appendix : bibliography

BIBLIOGRAPHY

Textbooks

Crouse, William H., and Donald L. Anglin. Automotive Body Repair and Refinishing. New York: McGraw-Hill Book Company, 1980.

Deroche, A. G., and N. N. Hildebrand. The Principles of Auto Body Repairing and Repainting. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1981.

Duenk, Lester G., W. Randolph Williams, and Clarence A. Brooks. Auto Body Repair. Peloria, Ill.: Chas. A. Bennett, Inc., 1977.

Hogg, John W. Auto Body Repair and Refinishing. 2nd ed. Scarborough, Ont.: McGraw-Hill Ryerson, Ltd., 1978.

MacPherson, Robert C. Collision Repair Guide. New York: McGraw-Hill Book Company, 1971.

Schmidt, Robert P. Autobody Repair and Refinishing. Englewood Cliffs, N. J.: Reston Publishing Co., Inc., 1981.

Toboldt, B. Auto Body Repairing and Repainting. South Holland, Ill.: The Goodheart-Willcox Company, Inc., 1979.

Reference Books

ABC's of Spray Equipment. Toledo, Ohio: The DeVilbiss Co., n.d. (free).

Abramson, Theodore, et al. Handbook of Vocational Education. Beverly Hills, Calif.: Sage Publications, 1979.

Adams, R. E. DACUM: Approach to Curriculum, Learning and Evaluation in Occupational Training. Yarmouth, N.S.: Department of Regional Expansion, 1975.

Andrews, Robert, and E. E. Ericson. Teaching Industrial Education Principles and Practices. Peloria, Ill.: Bennett Publishing Co., 1976.

Automotive Refinish Manual. St. Paul, Minn.: Minnesota Mining and Manufacturing Company, n.d.

Automotive Refinishing Principles and Techniques. Wilmington, Del.: E. I. Dupont de Nemours and Co., Refinish Division, n.d.

Bell, Norman T., and Allan J. Abedor. Developing Audio-Visual Instructional Modules for Vocational and Technical Training. Englewood Cliffs, N. J.: Educational Technology Publications, Inc., 1977.

Binks Air Spray Manual. Chicago, Ill.: Binks Manufacturing Co., n.d.

Bodywork and Painting (Illustrated). New York: Hearst Books, 1979.

Bond, Richard, et al. Vocational Education: Teaching the Handicapped in Regular Classes. Reston, Va.: Council for Exceptional Children, 1978.

Butler, F. Colt. Instructional Systems Development for Vocational and Technical Training. Englewood Cliffs, N. J.: Educational Technology Publications, 1972.

Butterworth, W. E. Wheels and Pistons. New York: Four Winds Press, 1971.

Calhoun, Calfrey C., and Alton V. Finch. Vocational Education: Concepts and Operations. 2nd ed. Belmont, Calif.: Wadwortor Publishing Company, 1982.

Canada Department of Employment and Immigration. Careers Manitoba, 1981. Ottawa: The Department, 1981.

Canada Department of Manpower and Immigration. An Analysis Auto Body Mechanic Trade. Ottawa: The Department, 1975.

----------. The Canadian Classification and Dictionary of Occupations. Ottawa: The Department, 1971-1973.

----------. Training Manual for Canadian Classification and Dictionary of Occupations. Vol. I. Ottawa: The Department, 1972.

Canadian Collision Estimating Guide. San Diego, Calif.: Mitchell Manuals, Inc. (published annually).

Chilton's Auto Repair Manual. Radnor, Pa.: Chilton Book Company (published annually).

Cross, Aleene A., ed. Vocational Instruction. Arlington, Va.: American Vocational Association, 1979.

Davis, Sharon. Vocational Education of Handicapped Students: A Guide for Policy Development. Reston, Va.: Council for Exceptional Children, 1978.

Diduck, Alison. Practical Legal Skills: Employment Rights and Responsibilities. Winnipeg: Public Legal Education Activities, 1981.

Employment Law. Winnipeg: Public Legal Education Activities, 1978.

Finch, Curtis R., and John R. Crunkilton. Curriculum Development in Vocational and Technical Education. Boston: Allyn and Bacon, Inc., 1979.

Future of Vocational Education. Arlington, Va.: American Vocational Association, 1981.

Georgano, G. N. The Complete Encyclopedia of Motorcars 1885-1968. rev. ed. New York: E. P. Dutton and Company, Inc., 1973.

Gianchino, J. W., et al. Welding Skills and Practices. 5th ed. Alsip, Ill.: American Technical Publications, Inc., 1977.

Giachino, J. W., and Ralph O. Gallington. Course Construction in Industrial Arts, Vocational and Technical Education. 4th ed. Chicago: American Technical Society, 1977.

Gibson, Dwight, and Terry Murphy. All About Law. Rexdale, Ont.: John Wiley and Sons, 1977.

Hebb, David. Wheels on the Road: A History of the Automobile from the Steam Engine to the Car of Tomorrow. New York: The Macmillan Company, 1966.

Integration of Technical and Vocational Education into Special Education. New York: Unipub, A Xerox Publishing Co., 1978.

Jennings, W. H., et al. Canadian Law. 3rd ed. Scarborough, Ont.: McGraw-Hill Ryerson, Ltd., 1979.

Lamar, Carl F., ed. Comprehensive Planning for Vocational Education: A Guide for Administrators. Arlington, Va.: American Vocational Association, 1978.

Law, Gordon, ed. Contemporary Concepts in Vocational Education. Washington, D.C.: American Vocational Association, 1971.

Leighbody, Gerald B. Vocational Education in America's Schools: Major Issues of the 1970's. Chicago: American Technical Society, 1972.

Leighbody, Gerald B., and Donald M. Kidd. Methods of Teaching Shop and Technical Subjects. Albany, N.Y.: Delmar Publishers, 1968.

McMahon, Gordon G. Curriculum Development in Trade and Industrial and Technical Education. Columbus, Ohio: Charles E. Merrill Publishing Co., 1972.

Manitoba Department of Education. Administrative Handbook for Manitoba Schools. Winnipeg, The Department, n.d.

----------. Safety/Health Guide for Industrial Arts, Vocational Industrial, Home Economics, and Business Education. Curriculum Support Series. Winnipeg: The Department, 1981.

Morris, Gwynn. The Story of Cars. New York: G. P. Putnam's Sons, 1963.

Orth, Mollie N., and Jill Frymier Russell. Curriculum Development Needs for Vocational Education: New and Changing Occupations. Columbus, Ohio: The National Center for Research in Vocational Education, 1981.

Paint Shop Manual. Wilmington, Del.: E. I. Dupont de Nemours and Co., Refinish Division, n.d. (free).

Palmonaki, Mary Jane, ed. Teaching Handicapped Students Vocational Education. Reston, Va.: National Education Association, 1981.

Pautler, Albert J. Teaching Shop and Laboratory Subjects. Columbus, Ohio: Charles E. Merrill Publishing Company, 1971.

Promoting Vocational Education: A Public Relations Handbook for Vocational Education. Arlington, Va.: American Vocational Association, 1978.

Refinishers Guide. Anaheim, Calif.: Rinshed-Mason Products Interchemical Corp., n.d.

Repaint Manual. Detroit, Mich.: Ditzler Refinish Division, RPG Industries, Inc., n.d.

Roberts, George Daniel. A Follow-Up Study of the Vocational Industrial Secondary School Program in Manitoba. Minneapolis, Minn.: University of Minnesota, 1978.

Roberts, Peter. Collector's History of the Automobile. New York: Bonanza Books, 1978.

Roberts, Roy W. Vocational and Practical Arts Education. New York: Harper and Row, 1971.

Russell, Jill Frymier. Implications of New and Changing Occupations for Industrial Development. Columbus, Ohio: The National Center for Research in Vocational Education, 1981.

Silvius, G. Harold, and Ralph C. Bohn. Planning and Organizing Instruction. Bloomington, Ill.: McKnight Publishing Company, 1976.

Spot Repairing Original Enamel Finishes (With Acrylic Lacquer) Handbook. Detroit, Mich.: Ford Service Publications, n.d.

Stockel, Martin W. Auto Service and Repair. South Holland, Ill.: The Goodheart-Willcox Company, Inc., 1978.

Venn, Grant. Man, Education, and Manpower. Washington, D.C.: American Association for School Administrators, 1970.

Wood, Merle. Developing Your Own Instructional Units. Arlington, Va.: American Vocational Association, 1980.

Manitoba Law Statutes

Manitoba. The Apprenticeship and Tradesmen's Qualifications Act, 1973-77.

----------. The Manitoba Public Insurance Corporation Act, 1974-1980.

----------. The Workers' Compensation Act, 1976-1979.

----------. The Workplace Safety and Health Act, 1977-1978.

Periodicals

Bodyshop. Wadham Publications, Limited, 109 Vanderhoof Avenue, Suite 101, Toronto, Ontario M4G 2J2 (bi-monthly).

Canadian Vocational Journal. Canadian Vocational Association, Suite 608, 251 Bank Street, Ottawa, Ontario K2P 1X3 (quarterly).

Industrial Education. Harcourt Brace Jovanovich Publications, 757 Third Avenue, New York, N.Y. 10017 (monthly).

Motor in Canada. Sanford Evans Publishing, Limited, 1077 St. James Street, P.O. Box 6900, Winnipeg, Manitoba R3C 3B1.

School Shop. Prakken Publications, Inc., 416 Longshore Drive, P.O. Box 8623, Ann Arbor, Michigan 48107 (monthly).

VocEd (formerly American Vocational Journal). American Vocational Association, 2020N 14th Street, Arlington, Va. 22201 (monthly).

Worklife: The Magazine of Employment Issues. Worklife Magazine, P.O. Box 2685, Postal Station D, Ottawa, Ontario K1P 5W7 (bi-monthly).

Audio-Visual Materials

The following audio-visual materials, published by DCA Educational Products, Warrington 18976, are available from Administration Information Media (AIM) Educational Aids, P.O. Box 86704, North Vancouver, B.C. V7L 4L2:

1. Sound Filmstrips

   - Introduction to Auto Body Shop Safety (IA1)
   - Auto Body Hand Tool Safety, Parts 1 and 2 (IA2, IA3)
   - Jacks, Hoist, and Crane Safety (IA4)
   - Auto Body Repair Safety-General (IA5)

2. Multi Media Units (consisting of audio tapes, filmstrips, worksheets)

   - Shop Safety (A-2A)
   - Oxy-Acetylene Equipment Set-up Procedure (C-5A)
   - Oxy-Acetylene Welding, Part 1 (C-6A)
   - Oxy-Acetylene Welding, Part 2 (C-6B)
   - Auto Body Safety (AB O-2A)
   - Using Portable Grinders Safely (AB E-1)
   - Portable Grinder Attachments and Grinding (AB E-2)
   - Body and Frame Construction (AB G-1)
   - Windshield Replacement (AB H-1)
   - Removing Glued-in Windshields (AB H-2A)
   - Installing Glued-in Windshields (AB H-2B)
   - Roughing and Alignment (AB I-1)
   - Solder Repair (AB J-2A)
   - Plastic Filler Repair (AB J-3A)
   - Shrinking Metal (AB K-1)
   - Sandpaper and Sanding (AB L-1)
   - Masking (AB L-2)
   - Surface Preparation for Repainting (AB L-3)
   - Paint Thinners and Reducers (AB L-4)
   - Frame Damage Analysis and Correction (AB M-1)
   - Painting Equipment (AB N-1)
   - Paint Preparation (AB N-2)
   - Acrylic Lacquer Refinishing (AB N-3)
   - Spot Painting and Blending (AB N-4)
   - Painting (AB N-5)
   - Paint Problems (AB N-6)
   - Synthetic Enamel Refinishing (AB N-7)
   - Acrylic Enamel Refinishing (AB N-8)
   - Final Preparation Before Painting the Entire Automobile (AB N-9)
   - Painting a Complete Automobile (AB N-10)
   - Tool Identification (AB P-1)
   - Quarter Panel Replacement (AB Q-1)
   - Fender Replacement (AB R-1)
   - Outer Door Panel Replacement (AB S-1)
   - Metal Finishing (AB T-1)

3. Colour-Sound Filmstrips

   - Electric Welding Safety and Setup
   - MIG Welding
   - TIG Welding
   - Resistance Welding: Assembly

4. Filmstrips, Slide Sets or Video Tapes

   - Assessment of Damage (9200)
   - Hand Tools (9201)
   - Metal Finishing (9202)
   - Minor Repair (9203)
   - Plastic Filler (9204)
   - Power Tools (9205)
   - Safety (9206)
   - Shrinking Metal (9207)

5. Multicoloured Transparencies with Overlays, Instructor's Guide and Library Case

   a) Auto Body Painting

   - Paint Ingredients (ABP-1)
   - Plastic Fillers, Part 1 (ABP-2)
   - Plastic Fillers, Part 2 (ABP-3)
   - Fiberglass Fillers (ABP-4)
   - Body Solder (ABP-5)
   - Common Leak Locations (ABP-6)
   - Testing for Leaks (ABP-7)
   - Applying Plastic Fillers (ABP-8)
   - Applying Body Solder (ABP-9)
   - Abrasive Grits (ABP-10)
   - Acrylic Spot and Panel Repairs (ABP-11)
   - Surface Rust-Out (ABP-12)
   - Fibreglass Repair Kit for Rust (ABP-13)
   - Blistering and Bull's Eye (ABP-14)
   - Blushing and Checking (ABP-15)
   - Chemical Discolouration and Crazing (ABP-16)
   - Dry Sray and Dirt in Paint (ABP-17)

- Off Colour, Etching, and Fish Eyes (ABP-18)
- Mottling and Excessive Orange Peel (ABP-19)
- Overspray and Rust Spots (ABP-20)
- Sand or File Marks and Sweat or Bloom; Sand Scratch Swelling (ABP-21)
- Thin Paint, Wheel Burn and Water Spotting (ABP-22)
- Safety and Health Precautions (ABP-23)
- Complete Spraying Systems (ABP-24)
- The Spray Gun (ABP-25)
- Cleaning the Spray Gun (ABP-26)
- Common Spray Gun Problems (ABP-27)
- Spraying the Paint (ABP-28)
- Correcting Distorted Patterns (ABP-29)
- The Paint Mixing Area (ABP-30)
- Matching Faded Colours (ABP-31)
- Matching Special Colours (ABP-32)
- Controlling Dust in a Typical Paint Booth (ABP-33)
- Masking and Taping (ABP-34)
- Drying Equipment (ABP-35)
- Wood Grain Transfers (ABP-36)
- Vinyl Top Replacement (ABP-37)
- Accent Stripes (ABP-38)
- Hand and Machine Compounding (ABP-39)
- Waxing, Polishing, Touch-Up (ABP-40)

b) Auto Body Parts (Group 1)

- The Auto Body (ABR-1)
- Outer Front Sheet Metal (ABR-2)
- Inner Front Sheet Metal (ABR-3)
- Outer Rear Sheet Metal (ABR-4)
- Inner Rear Sheet Metal (ABR-5)
- Methods of Molding Attachment (ABR-6)

c) Auto Shop Tools (Group 2)

- Basic Hand Tools (ABR-7)
- Special Hand Tools (ABR-8)
- Electric Power Tools (ABR-9)
- Air Power Tools (ABR-10)
- Auto Shop Specialty Tools (ABR-11)

d) Body Repair and Alignment (Group 3)

- Minor Body Dent Removal (ABR-12)
- Pick Hammering and Filing (ABR-13)
- Major Body Dent Removal (ABR-14)
- Rolled Buckle Repair and Shrinking (ABR-15)
- Welding Sheet Metal and Plastics (ABR-16)
- Welding with Electric Current (ABR-17)
- Checking the Body for Alignment (ABR-18)
- Straightening with Hydraulic Jacks (ABR-19)
- Portable Body and Frame Equipment (ABR-20)

e) Glass (Group 4)

- Butyl Tape Installations (ABR-21)
- Rubber Channel Installations (ABR-22)

f) Replacement Panels (Group 5)

- Sectioning Replacement Panels (ABR-23)
- Installing a Section of a Quarter Panel (ABR-24)

The following audio-visual materials are available from Prentice-Hall Media, 1870 Birchmount Road, Scarborough, Ontario MIP 2J7:

1. Colour Filmstrips with Cassettes and Instructor's Guide

a) Working in the Automobile Trade

- You, the Service Station Attendant
- So You Want to Work in an Auto Parts Dealership
- Your Job as an Auto Mechanic
- Your Job in the Autobody Repair Trade

b) Automotive Sheet Metal Repair

- Quarter Panel Repair (Solder Filling)
- Quarter Panel Repair (Plastic Filling)
- Fender Repair Using Jack with Heat
- Repairing a Door
- Rear Deck Lid Repair

c) Autobody Repair: Metal Work

- Hand Tools and Power Equipment
- Basic Straightening Methods
- Using the Body Jack and Frame Machine
- Using Fillers: Lead and Plastic
- Aligning Doors, Hoods, Trunk Lids
- Estimating Autobody Damage

d) Autobody Repair: Refinishing

- Sanding Techniques, Tools and Materials
- Use and Care of the Spray Gun
- Masking, Priming, and Puttying
- Spraying Colour
- Paint Faults and How to Correct Them
- Compounding and Polishing

e) Basic Automotive Service

- Automobile Battery Service

f) Arc Welding

- Basic Equipment
- The Welding Process
- Weld Joints

2. Colour Super 8 mm Film Loops

a) Film Loops on Automotive Sheet Metal Repair

- Stretching
- Upsetting
- Work Hardening
- Shrinking with Heat
- Hammering On-Dolly
- Hammering Off-Dolly
- Grinding or Power Sanding, Part I
- Grinding or Power Sanding, Part II
- Filing
- Filling with Solder, Part I
- Filling with Solder, Part II
- Roughing with the Hydraulic Jack

The following audio-visual material is available from Winnipeg Welding Supplies, Ltd., 45 Archibald Street, Winnipeg, Manitoba R2J 0W7:

Filmstrips, Cassettes and Booklets

- Gas Metal-Arc Welding (MIG)

The following audio-visual material is available from Vocational Filmstrip Company, A Division of Library Filmstrip Center, 3033 Aloma, Witchita, Kansas 67211:

Colour-Sound Filmstrip

- Auto Body: Assessment of Damage

The following audio-visual material is available from Chrysler Canada, P. O. Box 1621, Windsor, Ontario N9A 4H6, attention: Mr. N. Wheeler:

Colour-Sound 8 mm Film

- 1975 Intermediate--Model Body Highlighting
- 1979 Technical Features--New Yorker, Newport, St. Regis, Omni-Horizon
- Alignment Simplified
- Body Sealing

The following audio-visual material is available from Sperry, Inc., 1290 Avenue of the Americas, New York, New York 10019:

16 mm Films

- Basic Hydraulics (colour)
- Pressure Control Valves (black and white)

The following audio-visual material is available from Miller Electric Manufacturing Company, Appleton, Wisconsin:

16 mm Film

Arc Welding Methods (colour)

The following audio-visual material is available from General Motors of Canada, Oshawa, Ontario L1G 1K7, attention: Public Relations:

16 mm Film

- ABC of Hand Tools (colour)
- ABC of the Automobile (colour)

Other Support Materials

Bottom View, Auto Body and Frame Dimension - charts available from Rondex Limited, 260 Isabel Street, Winnipeg, Manitoba R3A 1H4.